ENERGY AND WATER DEVELOPMENT APPROPRIATIONS FOR FISCAL YEAR 1984

HEARINGS

BEFORE A

SUBCOMMITTEE OF THE

COMMITTEE ON APPROPRIATIONS

UNITED STATES SENATE

NINETY-EIGHTH CONGRESS

FIRST SESSION

ON

H.R. 3132

AN ACT MAKING APPROPRIATIONS FOR ENERGY AND WATER DEVELOPMENT FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1984, AND FOR OTHER PURPOSES

PART 2 (Pages 585-1312)

DEPARTMENT OF ENERGY

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CONTENTS

DEPARTMENT OF ENERGY

TUESDAY, FEBRUARY 22, 1983

Page
Secretary of Energy 585
Departmental administration 610

THURSDAY, FEBRUARY 24, 1983

Federal Power Marketing Administrations 663
  Bonneville Power Administration 675
  Western Area Power Administration 733
  Southwestern Power Administration 775
  Southeastern Power Administration 789
  Alaska Power Administration 805

TUESDAY, MARCH 1, 1983

Nuclear fission and uranium enrichment programs 813

THURSDAY, MARCH 3, 1983

Solar, conservation, and renewable energy programs 939

TUESDAY, MARCH 8, 1983

High-energy physics, basic research, environmental research, and magnetic fusion programs 981
Environment, safety, and health program 1061

THURSDAY, MARCH 17, 1983

Atomic energy defense activities 1079
Naval reactor development program 1217

ENERGY AND WATER DEVELOPMENT APPROPRIATIONS FOR FISCAL YEAR 1984

TUESDAY, FEBRUARY 22, 1983

U.S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Washington, D.C.

The subcommittee met at 2 p.m. in room SD–192, Dirksen Senate Office Building, Hon. Thad Cochran presiding.

Present: Senators Cochran, Abdnor, Johnston, and Burdick.

DEPARTMENT OF ENERGY

STATEMENT OF HON. DONALD PAUL HODEL, SECRETARY OF ENERGY

OPENING REMARKS

Senator COCHRAN. The subcommittee will please come to order.

Today, we begin our examination of the fiscal year 1984 budget for the Department of Energy programs under the jurisdiction of the Subcommittee on Energy and Water Development.

On behalf of the subcommittee and Chairman Hatfield, who is unavoidably detained in Oregon, I want to extend a very special welcome to the Secretary of Energy, Donald Paul Hodel.

Mr. Secretary, you have testified before this subcommittee several times in the past, but I believe this is your first appearance as the Secretary of Energy.

We look forward to your testimony on the proposed energy budget.

Before you do, however, Senator Johnston, do you have any remarks?

Senator JOHNSTON. No. That is fine, thank you.

Senator COCHRAN. Mr. Secretary, you may proceed.

PREPARED STATEMENT

Secretary HODEL. Mr. Chairman, we filed with the committee a copy of our prepared statement, which I will not go through. With the permission of the committee, I ask that it be included in the record.

Senator COCHRAN. It will be made a part of the record in full.

[The statement follows:]

Statement of Donald Paul Hodel, Secretary of Energy

Mr. Chairman, Members of the Committee, I appreciate the opportunity to discuss with you the FY 1984 budget request for the Department of Energy, and the energy policies of this Administration to which this budget is responsive.

Before presenting the details of the budget request, I would like to offer my perspective on energy and energy policy and describe the current energy situation.

ENERGY PERSPECTIVES

First, I believe that energy has an importance far beyond most commodities, because, directly and indirectly, energy is significant to every aspect of the U.S. economy. Domestic and international economic recovery and growth cannot take place without stable, reliable energy supplies that are available at a reasonable cost. Economic strength — and ultimately the strength and security of the free world — are dependent upon a purposeful energy policy that encourages efficient use of existing resources and timely development of technologies and resources for the future.

Another belief I hold very strongly is that overreliance on any one energy source is unwise, and that a balance among energy resources is needed. This Administration's energy policy seeks a balanced energy program that includes a full range of energy technologies which compete fairly in the free market. It is a policy that avoids overreliance on any one energy source and recognizes regional diversity in determining the optimum mix of energy supplies and patterns of energy use.

Finally, it is particularly important, I believe, to take note of energy conservation. Past supply disruptions and the impact of sudden price increases have led to increased investment in energy conservation. These investments have clearly demonstrated that conservation makes good business sense — and more importantly, that we must view conservation as a resource and not simply something we do for altruistic reasons.

These three principles—that energy is vital to a strong economy and, ultimately, to the strength of the Free World; that we must have a flexible and balanced approach to utilizing our energy resources; and that conservation should be viewed as an important energy resource—are beliefs I have held since my days as Administrator of the Bonneville Power Administration. These beliefs underlie the energy policies of the Reagan Administration and are embodied in the budget proposal I will present to you today.

THE CURRENT ENERGY SITUATION

As a Nation, we face a much more favorable energy situation than at any time during the past decade. In 1982, the United States produced about 90 percent of the energy it consumed, the highest level of energy self-reliance in almost ten years. Imported oil is down, both in absolute amount and as a percentage of consumption. This is a result of two heartening factors - an increase in domestic production since 1977, and a drop in domestic consumption, due in significant part to conservation practices in the face of increasing prices.

Moreover, the proportion of our oil imports coming from distant and potentially insecure Persian Gulf and North African sources has declined, and we have made more use of oil from nearby sources such as Mexico. Finally, since achievement of a better balance among various energy sources is a policy goal of this Administration, I am especially pleased to note that we have seen a significant change in the mix of fuels contributing to energy growth. Since 1973, virtually all of the energy growth has come from coal and nuclear power, whereas increased use of oil and natural gas fueled energy growth previously. This Nation has vast energy supplies and a growing capability to make use of all of them.

THE FEDERAL ROLE IN ENERGY

The Federal role in energy is one of fostering a climate that enhances national and international peace and security while assuring adequate and reliable energy supplies which are reasonably priced, environmentally acceptable, and efficiently used. Within this context, the Department of Energy has several specific goals which are reflected in our proposed budget for FY 1984 at levels which I believe to be appropriate in our current economic circumstances. These goals are:

- Support of long-range basic research programs.
- Conduct of energy-related applied research and technology development programs in areas that involve large, unpredictable and long-term risks, costs, or payoffs and therefore attract little or no private funding.
- Foster the development and utilization of a wide range of energy resources including conservation, and solar and other renewables, in addition to conventional resources.
- Manage programs and facilities for national defense in the areas of nuclear weapons, nuclear materials, and naval reactors.
- Develop and manage energy emergency preparedness policies and programs.
- Support U.S. international energy objectives and non-proliferation activities.
- Provide useful, objective energy information.
- Manage the Department efficiently and effectively.

BUDGET OVERVIEW

The FY 1984 budget request for the Department of Energy is $11.9 billion in budget authority, including $583 million in off-budget oil acquisition and transportation funds for the Strategic Petroleum Reserve. Anticipated outlays are $13.0 billion. The FY 1984 request represents a decrease of $933 million in budget authority from the levels appropriated in FY 1983. This decrease is the net effect of decreases in funding for Energy programs, the Strategic Petroleum Reserve, and Departmental Administration, offset in part by increases in Defense Activities and General Science.

Energy programs comprise about 30 percent of the Department's budget for FY 1984, approximately the same percentage as in the larger FY 1983 budget appropriated by Congress. The FY 1984 request continues the redirection of the Federal effort away from near-term technology demonstration in favor of longer-term, high-risk research and development, which has been a feature of this Administration's energy budget policy. Consistent with this policy, such longer term programs as Magnetic Fusion and Basic Energy Sciences show increases in FY 1984 over the level of FY 1983 appropriations. Fossil Energy, Conservation, and Solar and Other Renewable programs show reductions against the level of FY 1983 appropriations, reflecting a commitment to the support of longer-term technology base development activities rather than near-term product and process development that is better left to the private sector. Although our budget request in these technology areas is below the level of Congressional appropriations in FY 1983, it is higher than our FY 1983 budget request, and reflects a genuine attempt to accommodate certain Congressional concerns over the pace of our redirection.

I am pleased and very supportive of the budget's commitment to essential energy research and development. I believe we are making use of the taxpayers' dollars in the proper manner by applying those dollars where the need for Federal investments is indisputable, and resisting the temptation to support near-commercial technologies, where we might merely supplant funds the private sector could otherwise invest.

The Strategic Petroleum Reserve budget request is reduced significantly. This reduction does not signal a reversal of the Administration's support of the SPR as an essential element of protection against supply emergencies. It reflects overall budget requirements and an appreciation of the much improved world energy supply situation and the increased level of protection the SPR now provides as the result of our resolute development and fill practices. The Administration target continues to be the development of a 750 million barrel Strategic Petroleum Reserve.

The Departmental Administration funding request is reduced as a result of increased revenues and decreasing employment levels due primarily to the scaling-down of marginal programs.

The General Science program area is up sixteen percent over FY 1983, due primarily to utilization of a number of major new research facilities just now coming on line and acceleration of an important construction project.

Finally, Defense Activities represents over half of the total budget request for the Department in FY 1984. The request of almost $6.8 billion represents a nineteen percent increase from FY 1983, and reflects the Department's commitment to fulfill the requirements of the Department of Defense for nuclear weapons and materials production.

The budget we are proposing is presented in a format appropriate to the existing Department of Energy. However, the Administration believes that the nature of the Federal effort required to assist in meeting national energy objectives no longer requires a separate Cabinet-level agency devoted solely to energy.

I would now like to discuss the funding request for selected major program elements.

FOSSIL ENERGY

The United States has abundant domestic supplies of coal, petroleum, oil shale, and natural gas, and the role of the Department's Fossil Energy program is to help establish an adequate scientific and engineering knowledge base so that the private sector can apply new and improved technologies for making use of these vast resources. Consequently, the Department concentrates on applied research and technology development which industry could not be expected to undertake on its own, while leaving the commercial introduction of developed technologies to the private sector.

The FY 1984 budget request for fossil energy programs is $138 million, which is to be partially offset by $44 million in prior year balances. This constitutes a considerable reduction from the FY 1983 appropriation of $311 million, but is approximately 27 percent higher than our request in FY 1983. I believe our request is fully adequate to fulfill the proper Federal role and build upon past Federal investments in fossil technology. Approximately $110 million of the request is for programs designed to better utilize the Nation's coal reserves. The major funding element within the coal program is the Advanced Research and Technology Development program, which is to receive almost 30 percent of the overall funding. The remaining funds are applied in a balanced manner to liquefaction and gasification technologies, coal preparation, fuel cells, combustion systems and heat engine research.

CONSERVATION

The aim of the Energy Conservation Research program is to conduct basic research in fields of scientific inquiry where new knowledge can expand the generic technology base underlying energy conservation. This will support private sector efforts to develop ways to make more efficient use of available energy and to facilitate use of nonpetroleum energy sources. The FY 1984 budget for Conservation activities, including Electric Energy Systems and Energy Storage programs, is $101 million, almost $80 million more than the Department's FY 1983 request. Electric Energy Systems and Energy Storage together account for $27 million. The $74 million requested in the Conservation appropriation account is divided among the various end-use sectors the research effort supports, such as Buildings and Community Systems, Industrial Energy Conservation, and Transportation.

In FY 1984, the major focus to the Buildings area will be on performing technology base research and development that will allow the private sector to improve the energy efficiency of buildings, insulation, heat pumps, and furnaces. The Industrial program will concentrate on combustion efficiency improvements, waste heat recuperators, industrial heat pumps, conversion of industrial waste to fuels and feedstocks, energy efficient separation systems, and process control systems. In the Transportation area, major efforts will continue in heat engine development, development of electric vehicle battery and propulsion systems, alternative fuels utilization, and development of advanced materials.

The Department's budget requests $3 million for the management resources required to perform an orderly closeout of the State and Local conservation grants programs. We believe that the Administration should continue to assist the needy to adjust to high energy prices through the Low Income Home Energy Assistance Program administered by the Department of Health and Human Services.

SOLAR AND OTHER RENEWABLES

Solar and Other Renewable Energy resources offer the potential for significant energy contributions over the long term. In addition to direct solar energy technologies, such as photovoltaics and solar thermal, this energy research category includes biomass, wind, and geothermal energy technologies. The budget request in FY 1984 is $102 million, approximately 29 percent above our budget request in FY 1983.

A number of solar applications are competitive today in certain regions. Consequently, the Department's programs will concentrate on technology base development in certain areas, such as advanced photovoltaics, where the investment risks are high and industry cannot be expected to undertake completely the long-term research necessary to bring the technologies to the point of commercial introduction.

The largest program element within the Solar research area is Photovoltaics, for which the budget request is $33 million. The thrust of the photovoltaics program will be on establishing the scientific feasibility of advance photovoltaic materials, because a five-fold improvement in efficiency/cost is required for sustained market penetration.

Other major elements of the budget request include Solar Thermal, Biomass, and Geothermal. Our $22 million program in Solar Thermal will emphasize materials research, central receiver technology, and heat transfer systems analyses. The Biomass program will concentrate on research and development on thermochemical and biochemical conversion processes capable of producing solid, liquid and gaseous fuels from organic material, and will investigate methods of increasing algal biomass feedstocks through species screening and genetic engineering. The Biomass budget request is $17 million.

The Geothermal budget request of $14 million supports a technology base development program which can be used by the private sector for future development of geothermal energy sites.

GENERAL SCIENCE

The programs included in the General Science appropriation support basic research into the fundamental structure and behavior of matter. Much of this work has no direct or immediate application to energy technologies, and it is carried out as an endeavor for the advancement of the frontiers of science.

The budget request for FY 1984 is $645 million, a sixteen percent increase over the FY 1983 figure of $554 million. The increase is due to the expanded research opportunities provided by the availability of major new facilities in the High Energy Physics and Nuclear Physics programs. In High Energy Physics, FY 1984 will see the first full year of operation of the Energy Saver superconducting synchrotron at Fermilab. Also at Fermilab, construction will continue on the Tevatron I and II construction projects, and construction of the SLAC Linear Collider will be accelerated at the Stanford Linear Accelerator facility.

The Nuclear Physics program will make use of new facilities at the Lawrence Berkeley, Oak Ridge, and Argonne National Laboratories and the Bates Electron Accelerator Laboratory. Also, Van de Graaf accelerators at Yale and the University of Washington will be upgraded.

BASIC ENERGY SCIENCES

The Basic Energy Sciences program seeks to provide fundamental scientific knowledge relevant to energy exploration, production, conversion, conservation, and use. The proposed budget for FY 1984 is $350 million, approximately

24 percent above the amount appropriated in FY 1983. A major portion of the increase is associated with an advanced materials research initiative which includes two major construction projects and related research and equipment. The new construction projects are a National Center for Advanced Materials at Lawrence Berkeley Laboratory and expansion of the research capability of the National Synchrotron Light Source at the Brookhaven National Laboratory.

MAGNETIC FUSION

Successful development of fusion energy would ultimately provide access to an inexpensive and essentially inexhaustible domestic energy resource base. The objective of the Magnetic Fusion Energy program is to develop an economically competitive technology in an environmentally sound manner.

Two confinement concepts, the tokamak and the tandem mirror, are developed to the point that both are ready to attempt production of reactor-grade plasmas. In FY 1983-84, several major new fusion facilities will begin operations: the Large Coil Project, the Tritium System Test Assembly, and the Tokamak Fusion Test Reactor (TFTR). In 1986, the TFTR will be the first fusion device in the world to attempt to demonstrate energy breakeven.

The FY 1984 budget request of $467 million will provide the necessary support for continuing the development of the two leading fusion concepts, tokamaks and tandem mirrors, and for limited support of experiments on alternate confinement concepts, including the Reverse Field Pinch and Compact Toroids. Another significant element of the FY 1984 budget strategy is to maximize coordination with foreign fusion programs, including those in Japan, West Germany, and the USSR, and provide limited funding to continue design and development activities on the Fusion Materials Irradation Test Facility in anticipation that an international agreement can be reached on joint construction funding.

NUCLEAR FISSION

The Department's Nuclear Fission activities are designed to provide the technological base to revitalize industry's efforts to continue the development of nuclear power as an economic and environmentally acceptable source of base-load electric power. The program includes research on conventional reactors as well as breeder reactor systems, and concentrates also on nuclear waste and fuel reprocessing technologies. The FY 1984 budget request is $848 million.

The largest element in the Nuclear Fission budget is Breeder Reactor Systems. The request for Breeder Reactor Systems is $603 million, of which $270 million is for the Clinch River Breeder Reactor (CRBR) project. Funding for the CRBR was provided for FY 1983 subject to certain restrictions on its use, and with a requirement for a vigorous exploration of possible methods of reducing Federal budget requirements for the CRBR or alternative projects. I am fully aware of the depth of Congressional concern, and I intend to fulfill my pledge to seek alternative methods of financing this costly but extremely valuable project. If we are unable to produce an alternative funding proposal, I have indicated that we cannot expect the Congress to fund our FY 1984 budget request.

Assuming the CRBR proceeds as planned, site preparation activities will be essentially completed in FY 1983. In FY 1984, plant design will be virtually completed and construction of the plant foundations will begin upon receipt of authorization from the Nuclear Regulatory Commission.

In addition to the CRBR, a $272 million breeder base technology program is proposed to develop components, fuels, core designs, engineering systems, and materials suitable for breeder reactors, and to operate a number of highly specialized facilities which test components, safety procedures, and system operations. If we do not proceed with the CRBR, we will have to evaluate which of these efforts must continue and at what levels.

NUCLEAR WASTE DISPOSAL ACTIVITIES

One of the great achievements of the 97th Congress was the passage of the Nuclear Waste Policy Act of 1982 on December 20, 1982. This legislation, signed into law by the President on January 7, 1983, establishes a Fund to finance activities related to development, construction and operation of a commercial high-level waste repository and development of the Monitored Retrievable Storage option.

The Fund is to be financed by fees paid by nuclear utilities. The budget request in FY 1984 is $307 million, while fee collections are expected to total $448 million. Revenues are to offset required budget authority, with revenues in excess of requirements being retained in the Fund as offsets to future needs.

Efforts in the Waste Disposal program are directed toward site selection, licensing, construction, and operation of mined geologic repositories, and will include activities such as site characterization and exploratory shaft development. To ensure that the requirements of the Waste Bill are fully understood and acted upon as promptly as possible, I have detailed a number of Department of Energy employees from the Policy and Planning organization to a special task group for this purpose.

The program is now focusing on four main geographic areas: the basalt flows underlying the Hanford Site in Washington, the tuffs underlying Yucca Mountain at the Nevada Test Site, salt domes in the Gulf Coast States, and bedded salt formations in Texas and Utah. Nationwide screening of additional sites in other geologic media, such as the granitic rocks of the Lake Superior and Appalachian region, will continue.

URANIUM ENRICHMENT

The FY 1984 budget request for uranium enrichment activities is $2,240 million. This includes funding requirements for the three major elements of the program: gaseous diffusion operations and support ($1,485 million); gas centrifuge operations and support ($681 million); and advanced isotope separation ($73 million). Funds requested for gaseous diffusion operations are primarily for electric power required for the production of 12.1 million separative work units (SWU) of enriched product. The costs of the program are completely offset by revenues from the sale of enriched uranium.

The FY 1984 budget also requests funds for the Portsmouth Gas Centrifuge Enrichment Plant (GCEP). The importance of the gas centrifuge technology is that it uses less than five percent of the power required by the gaseous diffusion technology, and can therefore provide enrichment services at a significantly lower cost. Lowering production costs is essential if the United States is to remain competitive in the world market for enrichment services.

The Advanced Isotope Separation program has the goal of developing the Atomic Vapor Laser Isotope Separation process to the point where it can provide for the production of enriched uranium at significantly reduced cost. The FY 1984 budget request will initiate evaluation of engineering issues and system reliability, for possible future construction and operation of a Development/Demonstration Module in the late 1980's.

STRATEGIC PETROLEUM RESERVE

The budget request for the Strategic Petroleum Reserve (SPR) is $742 million. This figure is well below the FY 1983 appropriation. The off-budget request for oil acquisition and transportation is $583 million. In FY 1983, our currently planned average daily fill rate will be 220,000 barrels per day. During FY 1984, the fill rate would be 145,000 barrels per day. The budget will permit a cumulative fill of 410 million barrels by the end of FY 1984. We are requesting $142 million for facilities development, to be divided between Phase II and non-phase-specific activities. Phase II, the expansion of three existing storage sites, will add 290 million barrels of storage capacity. Non-phase specific activities include ongoing operations and maintenance, systems reliability improvements and safety upgrading.

Phase III development at Bryan Mound and West Hackberry will continue from funding in FY 1983 to be made available in FY 1984. The FY 1983 budget will continue Big Hill site acquisition activities and completion of detailed design work. However, a decision on whether to proceed with construction activities at the Big Hill site will be reanalyzed within the context of the FY 1985 budget.

The SPR budget request reflects in the first instance the Administration's efforts to trim the federal budget wherever it is prudent to do so. I am aware of the bipartisan Congressional commitment--which is shared fully by the Administration--to enhancement of national security and protection against petroleum supply emergencies by, among other measures, providing for rapid fill of the Strategic Petroleum Reserve. I need not and will not take a back seat to anybody in my resolve that Federal energy policies and programs be designed and administered to contribute optimally to our Nation's economic and strategic security.

Overall budget considerations have compelled the Administration to propose reductions in a variety of programs, including but not limited to SPR, which we wish we could have avoided. Although outlays for SPR petroleum purchases are off-budget, they affect Federal borrowing and economic activity the same as on-budget spending.

If the Department were to fill at a 220,000 barrel per day rate during FY 1984, total program costs would be increased by more than the direct additional outlay of some $900 million for oil purchases and transportation. Interim storage, at an estimated cost ranging from over $1 to $5 per barrel per year, would be required for approximately 10 million barrels. Moreover, purchases of an additional 27.4 million barrels of oil in FY 1984 (representing the difference between fill rates of 220,000 and 145,000 barrels per day) would have to be made with borrowed money. One cannot ignore the cost of borrowing those funds. Based on current forecasts, purchases of oil made today with borrowed money would require outlays in excess of those required to purchase the same amount of oil in FY 1985.

The budget request for FY 1984 also takes into account the dramatically improved world oil market. When plans for the SPR were developed five years ago, they were based on projected 1985 imports of as much as 11 million barrels per day. Current Department forecasts project United States imports of only about 6 million barrels per day in 1985, up to a 45 percent reduction, and actual net imports in 1982 were at a level of only 4.2 million barrels per day. Arab OPEC imports to this country have declined from a 1979 peak of 3.2 million barrels per day to about 900,000 barrels per day in 1982, and now constitute only 21 percent of our total net imports. Unlike the situations in 1973 and 1979, there now is substantial excess production capacity in the free world, including OPEC nations. These factors tend to reduce both the impacts of unexpected supply disruptions and the incentive to use oil embargoes as weapons in international politics.

Moreover, the United States and its allies are much better prepared today to deal effectively with disruptions in oil supplies. The SPR now holds 300 million barrels, nearly three times as much oil as there was at the beginning of this Administration. Counterproductive controls have been abolished, so that any subsequent disruption would not be accompanied by the market distortions we experienced in the past.

The selection of any given fill rate represents a judgment as to what is prudent in the circumstances. Measured in terms of the approximately 6 million barrels per day of imports projected by DOE for 1985, the fill rate contemplated by the Energy Emergency Preparedness Act without regard to availability of funds would provide 83 days of coverage against such imports. Under the presently proposed fill rates, there would be 74 days of such coverage—a difference of only 9 days.

That difference is not so great, in our view, to warrant walking away from the substantial budget savings sought by today's proposal. Moreover, we, in conjunction with our sister agencies, intend to monitor the world oil situation—in terms of both the likelihood of future supply disruptions and probable future price levels—so that we may take advantage of future opportunities to acquire oil at potentially lower costs and, when appropriate, rapidly fill available SPR capacity.

The SPR budget request represents a balanced approach of reducing present costs of the program in light of overall budget considerations while, at the same time, continuing at a reasonable rate the growing capability of SPR to provide economic and strategic security to the Nation.

DEFENSE ACTIVITIES

The budget request for Defense Activities is $6.8 billion, an increase of $1.1 billion over FY 1983. The budget is higher in every major category, with the major increases occurring in Weapons Activities, Materials Production, Defense Waste, and Naval Reactors.

Within Weapons Activities, the Research, Development and Testing program is up $195 million. This program generates new concepts for nuclear weapons and applies them to Department of Defense requirements. Another major program element, Production and Surveillance, is up $436 million over FY 1983 because of increased Department of Defense requirements for production of new nuclear weapons for the stockpile, improvement of selected older weapons in the stockpile, and surveillance and maintenance of existing weapons, as approved by the President in the Nuclear Weapons Stockpile Memorandum.

The weapons in production include the B61-3 Bomb, B61-4 Bomb, W76 TRIDENT Warhead, W79 8-inch Artillery Fired Atomic Projectile Warhead, W80-0 Sea Launched Cruise Missile Warhead, W80-1 Air Launched Cruise Missile Warhead, B-83 Bomb, W84 Ground Launched Cruise Missile Warhead and the W85 Pershing II Warhead. Also included are pre-delivery production efforts which will be conducted in FY 1984 for the W81 Standard Missile 2, W82 155mm Artillery Fired Atomic Projectile, W87 MX, and Sentry Warheads. Funding is also requested to maintain and rehabilitate facilities throughout the weapons production complex.

The Materials Production program, which supports the production of nuclear materials for national security programs, is up $283 million over FY 1983. The FY 1984 budget request provides funds for the first full year of operation of the L Reactor at Savannah River after completion in FY 1983 of upgrade activities started in FY 1981. Also, the budget request provides funds to complete reactivation and begin operation of the PUREX processing plant at Richland and to continue the Facilities Restoration program.

The Defense Waste and Byproducts Management program will begin construction of the Defense Waste Processing Facility at Savannah River, and will continue the program of transferring high-level waste from single-shell tanks at Savannah River and Hanford into new double-shell tanks. Also, efforts will continue on the preparation of transuranic wastes at various Department of Energy sites for shipment to the Waste Isolation Pilot Plant under construction near Carlsbad, New Mexico.

Mr. Chairman, I believe that the budget I have just summarized will permit us to perform those energy functions which are the unique responsibility of the Federal government. The Department of Energy is fully prepared to work with the Congress in the coming months to ensure that the course charted for us in FY 1984 represents a true consensus.

SUMMARY OF STATEMENT

Secretary HODEL. I would like to talk briefly about the trends I think are important in this budget and then move to the questions the committee may have.

ATOMIC ENERGY DEFENSE PROGRAMS

In this budget, we have increased our defense programs appropriation request. This is pursuant to the nuclear weapons stockpile memorandum. The majority of the increase, approximately $700 million, has to do with weapons production, and production of nuclear materials for weapons.

We also have some facilities restoration and maintenance, and we have a new initiative in the defense waste processing facility, which is a $155 million request.

ENERGY RESEARCH AND DEVELOPMENT

In energy research and development in this budget, we have a number of areas where the Congress has provided us with larger sums of money in the Fiscal Year 1983 Continuing Resolution than the amounts we are requesting in this budget.

I am well aware of that. But we also have increased the requests of the Department in the areas for conservation, for renewables, and for fossil, over the level of request of last year. I was very much aware in my confirmation hearing that there was concern on the part of the Congress that we do not have what could be viewed as a balanced approach to the research and development portion of the Department of Energy budget, and I have attempted to move in the direction of remedying that imbalance, although obviously we have not come as far as the committee requested us to.

GENERAL AND BASIC ENERGY SCIENCES

In the area of general science, we have an increased request over last year's appropriation. It is, I think, interesting to note that this administration, at a time of serious budget deficits, has made stringent efforts to reduce the size of the budget, but has increased its request in the area of general science and basic energy sciences. This increase primarily is for some major projects, which we think are important to the scientific community and, therefore, we support them strongly.

I have a couple of issues which I think I need to mention.

CONSERVATION AND RENEWABLE RESEARCH

First, I recently have returned from a visit to a number of laboratories and test sites. In those visits, I have encountered numerous questions about what we intend to do as a Department to deal with the concern that as OPEC prices and, therefore, world oil prices drop, there may be a lessening of enthusiasm in this country for conservation and renewable activities. It is my desire to see to it that we provide some real momentum to the effort to focus attention on those activities.

In the long haul, there is no question this country needs to have continued emphasis on conservation and renewables.

I have asked our Assistant Secretary for Conservation and Renewable Energy to provide me with a series of options we could pursue which would focus attention on those activities and we have, of course, increased budget requests in those areas.

CLINCH RIVER BREEDER REACTOR

With regard to the Clinch River Breeder Reactor, as the committee is well aware, the continuing resolution allows us until March 15 to come back to this committee, to the Congress, with a proposal for how we can obtain non-Federal financing or support for that project. I have been quite candid in my statements regarding the Clinch River Breeder Reactor.

First of all, I support the project, I support the breeder reactor, but I do not believe we can continue to ask Congress to support it with the

Federal funding that has been called for in the past and we must find a means of obtaining non-Federal support from the utilities industry and manufacturers for that project.

We have a task force working diligently on that. I am quite optimistic it will come forward with some really constructive proposals for private-sector participation in the project.

GENERAL SCIENCE AND BASIC RESEARCH

Finally, I increasingly have focused my attention, as I have become more familiar with the Department, on the importance of the general science and the science and technology aspects of this Department.

If we can identify the areas of activity in science and technology that hold the greatest promise for this country and obtain a commitment between the administration and the Congress for that basic research and development, we, as an administration, are prepared to support that wholeheartedly.

My recent visits to the various laboratories strongly have reinforced that support. When I was at Fermi Lab, outside of Chicago, I was impressed with the significance of what is essentially a basic research facility dealing with the smallest particles of matter. As far as that science is concerned, there is very little likelihood of its immediate transfer to an industry or to a commercial establishment. Yet the spinoffs that already are taking place from the technology that was developed to permit the experiment to take place are intriguing.

Cryogenic technology, including superconducting magnets and the study of the characteristics of matter at near absolute zero, is extremely interesting to me. I think these are important areas we should pursue.

With that, Mr. Chairman, I would be happy to submit myself to questions.

DEREGULATION OF NATURAL GAS

Senator COCHRAN. Thank you very much, Mr. Secretary. I note that in your appearance before the Energy Committee, a discussion resulted concerning the deregulation plans of the Department. I know that this is not something that may be directly under the jurisdiction of this subcommittee, but what, in your judgment, will be the budgetary impact, if any, of any proposal by the administration to accelerate the deregulation of natural gas.

Secretary HODEL. Mr. Chairman, I would like to characterize our approach in these terms. We felt if we were to come forward with a proposal to deregulate, or a proposal just to deal with contracts, which is what I would call the standard or conventional thought that has been going into this process, that we would not, in fact, have a viable package. We have come up with a set of principles, an important component of which is an assurance of consumer protection.

We believe that the market will work, and we believe it will have an effect of reducing the price of gas. I have said on a number of occasions that every first-year economics student can tell you if you have a surplus of supply over demand, the price will go down. So you expect that to happen with natural gas and it isn't, and the reason is the current regulatory market situation. So we have proposed a bill which has a strong consumer assurance portion to it.

I say "proposed a bill;" we produced a proposal, and we are working on a bill, which will provide strong assurance to consumers that they will not run the risk that the market might not work or work immediately to have the effect of reducing price.

If it works as I expect, which is to reduce the price, I would expect a renewed increase in economic activity resulting from it. That renewed economic activity ought to produce revenues. If it has a budgetary effect, I think it will be all beneficial.

Senator Cochran. Do you think the long-range benefit to consumers has been well thought out, and it is assured that there will be benefit rather than just an increase in cost to consumers?

Secretary Hodel. Yes, Mr. Chairman. In fact, as proposed—and as we presently are working on the proposal—the only direction the price can move, certainly in the near term, is downward, which is appropriate in view of the supply and demand situation. Over time, whether the price moves back to the present level or above that will be dependent upon a showing that the contracts that cause that to happen are prudent.

NUCLEAR AND RENEWABLE ENERGY PROGRAM BALANCE

Senator Cochran. In the R&D side of the budget, there are substantial reductions in the spending levels requested, as much as 60 to 70 percent below last year's levels of spending, particularly in the conservation, solar, and fossil fuel programs. There may be a suggestion that this could be an unbalanced program if we have too much of the money going to nuclear or other parts of the budget and not as much on the corresponding side for conservation programs and renewable resource research.

What is your response to that possible criticism?

Secretary Hodel. The funding levels that we have requested for conservation programs, $101 million including electric energy systems and energy storage, as compared to the request of last year of $22 million, represents a 4½ times increase, but it is well below the level, as I said, appropriated by the Congress in the 1983 Continuing Resolution and the Fiscal Year 1983 Interior Appropriation Act.

In looking at the conservation portion of our budget, it is important to recognize that of the $410 million appropriated for fiscal year 1983, some $234 million relates to State and local grant programs, primarily the weatherization program. That is an area where we, as an administration, have continued to recommend that that money ought to come through the Department of Health and Human Services because there is no point in having two channels for funneling that money to the States and localities. So if we exclude that $234 million, that leaves us about $163 or $165 million that was appropriated by the Congress for R&D. That relates to the $101 million request for R&D, and while it is well below the appropriated level, it is well above what we previously had requested. I am hoping, with this committee's guidance and that of its staff, that we can identify if we have established the right priorities within the $101 million and whether we need to add or substitute projects between $101 million and $163 million that ought to be done. Much the same rationale applies to both fossil and renewables where clearly our request is below the level provided in this year's Interior Appropriation Act and continuing resolution.

TERMINATION OF DOE

Senator COCHRAN. Does the budget contemplate any savings that would be achieved because of any merger of programs in the Department of Energy with another department or the taking over of certain function by the Commerce Department of any other department?

Secretary HODEL. Yes, it does.

In the area of management and administration, we make some assumptions in the preparation of this budget for fiscal year 1984 that we would be combined with some other department and that there would, therefore, be some modest adjustments in those figures. One of the questions that arises obviously is, Well, what happens if you don't merge? I must say we have had some experience with that already, and we seem to be able to make the adjustment and continue with the level of personnel that are needed to keep a separate department operating.

Senator COCHRAN. But do you anticipate any additional funding or supplemental requirements in case merger is not forthcoming?

Secretary HODEL. Mr. Chairman, we would have to reevaluate that question at the time when we found out to what extent our planning levels and retention levels would not mesh.

NUCLEAR WASTE DISPOSAL

Senator COCHRAN. I was looking at the breakdown of the 1984 funding request that deals with the management of the nuclear waste storage program and noticed that there were some substantial increases in the budget with respect to site characterization for salt formations.

Could you tell me why the relatively large increase in funding is needed?

For example, you have three specific geologic structures, formations that will be studied apparently during the year—basalt, tuff in Nevada, and salt, bedded and dome as well. Out of the three, the salt carries the biggest price tag in the budget of $112 million, as compared with $80 million for tuff and $59.8 million for basalt. Why that sharp disparity, particularly when compared to previous years when they were relatively equal?

Secretary HODEL. Mr. Chairman, I would have to speculate, but I think it would be because as we move into the effort in salt, we are looking at two kinds of salt areas, and it may be that we are essentially duplicating the effort that is in the rock formations. Also, I think we have not done as much preliminary work in those areas yet as we have done in the rock formations.

Senator COCHRAN. During the discussion in the Senate on the nuclear waste bill, which was adopted last year, there was an assurance at that time of the intent of the Congress to expand studies to include granite and other geologic formations which might not have been carefully studied as possible sites for permanent storage of nuclear waste material. But in your proposed budget there is very little money requested for any such studies. Is it the intention of the Department to go forward in expanding the regions and the types of geologic formations that we may have available to you for possible storage sites or is it the intention of the Department to continue to restrict its studies to those sites that have previously been studied?

Secretary HODEL. Mr. Chairman, under the act, we are given a very tight deadline within which to proceed with the first repository. We have identified the six States in which we are pursuing that effort. We are also notifying 17 additional States that for a future permanent waste disposal site, we are looking at rock formations in their States. I would have to assume that in order to do the kind of work that is called for, and the detail that is required, it would be necessary to do that kind of work in the follow-on work, the second phase, as we have had to identify in an effort to move in accordance with the statute those about which we already know a great deal.

Senator COCHRAN. Is there any kind of timetable being developed so that you will know when to expect to have granite or other rock sites ready for site characterization and how much money you may need to complete this process?

Secretary HODEL. If I am correct, it belongs in the second phase. It would be some period of time yet before we would be at that stage where we would be able to make a schedule of those events, because we are at the very most preliminary stages of identifying basic geologic structures so that, as a part of that process, I would think we would put together the appropriate time lines and indicate where we would proceed. Also affecting it would be the results of our work at the first site, which, at the present time, involves salt and tuff.

Until we have proceeded to some extent down that road, it probably would be hard to come up with a definitive timetable on the other.

SITE SELECTION

Senator COCHRAN. What worries me is whether or not the Department is sensitive to the concern I have that you understand that you haven't been legislatively required to select the site from those that have presently been studied. Do you feel that that is the requirement of the legislation and you are restricting your funding just to those areas that have come under preliminary review and will make a selection from those whether they prove to be safe or satisfactory or not?

Secretary HODEL. Mr. Chairman, my impression and my understanding from the advice I have received from staff is that we have done an extensive amount of work. Large sums of money have been spent on doing preliminary characterizations with the two rocks and the two kinds of salt which we have been working with to date. And I would have to believe that we have reached that stage as a thoughtful, careful process, that it is quite appropriate for us at this stage to carry out the characterization under the act, and we can do that with those sites, we can do that with those kinds of materials, in a timely fashion. It would be very difficult to bring a new material in at this stage and analyze it.

I suspect we have done some work with granite and it was concluded that it did not have clearly superior qualities which would require moving in it and, therefore, I don't believe that we would find if we analyze that, that we have forsaken real opportunities by placing the prospects for granite in the second rank of considerations at this time.

Senator COCHRAN. I have some more specific questions concerning the nuclear waste program which I will submit to you in writing and request that you simply respond for the record so we won't drag this hearing out unnecessarily in a prolonged discussion of that one area of the budget.

I hope you will be able to respond to those in a timely fashion. We can just include all that in the record.

Secretary HODEL. Mr. Chairman, I am advised by the Assistant Secretary for Nuclear Energy, who is my expert on this subject, will be before this committee on March 1.

PREPARED QUESTIONS FROM SENATOR COCHRAN AND SENATOR HATFIELD

Senator COCHRAN. He will. I won't be able to be at that hearing and that is why I was bringing it up. I wanted to get your thoughts. I will submit those additional questions for the record.

I realize he will be prepared to make specific responses to those questions.

Secretary HODEL. Thank you, Mr. Chairman.

Senator COCHRAN. Senator Hatfield also has questions which will be included in the record for your response. If it is satisfactory with you, we will simply submit all of those questions to you today.

Secretary HODEL. Thank you.

[The questions and answers follow:]

QUESTIONS SUBMITTED BY SENATOR COCHRAN

Question: How much of the funds requested for Salt studies in FY 1984 will be used for the construction of the exploratory shaft in the primary salt site? Do you anticipate more than one shaft in salt? Do you expect to nominate more than three candidate salt sites or to characterize more than one?

Answer: The FY 1984 budget request includes $34 million for the construction of exploratory shafts in salt. In addition, $8 million is requested for land acquisition for the shaft sites. The Department does not plan to construct more than one exploratory shaft in salt, nor does the Department expect to nominate more than three candidate salt sites or to characterize more than one salt site.

Question: Has any financial commitment for FY 1984 been made by the Department for additional studies of the Salina Salt Basin? If so, how much is anticipated to be spent there? Is it within the Department's program schedule to bring Salina Salt into the picture for either the first or second repository?

Answer: The Department has not made any commitment to do additional studies in the Salina Salt Basin. Currently the Department is not considering the Salina Basin for the first repository. The Department is in the process of developing its siting program for the second repository and has not precluded the Salina Basin for further study.

Question: How soon do you expect to have granite or other crystalline rock sites ready for site characterization? How much money would you need to complete this process? How much additional funds would you need for site characterization of this medium?

Answer: Crystalline rock studies have been incorporated into the program for developing a second repository site to be selected by the President in 1990. Presently, 17 states have been identified as having crystalline rock formations that will be studied by the Department. The Department intends to identify potentially acceptable sites from among these formations by early FY 1984. Continued winnowing, using available literature and surface surveys of potential plutons, is planned in 1983 and 1984. Supplemental funds are required for a field test program in order to find a crystalline rock site suitable by 1989 when three sites must be recommended to the President for the 1990 decision. The Department currently is reviewing the funding requirements needed to meet these dates.

Question: Are you aware of the recent study conducted by scientist affiliated with the Oak Ridge National Laboratory which tends to show that granite rock even under adverse conditions would safely contain radioactivity? What action has the Department taken (or is going to take) to follow-up this study? How much money has been committed to that effort?

Answer: The Department was not aware of the referenced study. However, efforts are being made to obtain a copy of the study. Until the study has been located, the Department cannot make a decision for any follow-up studies or commit any funds.

Question: The Budget Request provides $1.5 million for assistance to states in FY 1984. Do you have a breakdown of that figure by state? Will that provide sufficient funds for all the states where an exploratory shaft will be built and for those states where studies will continue? How much is New Mexico now receiving in connection with WIPP site (the defense test facility)?

Answer: The Department did not budget specific amounts for each state, as the actual amounts will be a function of the specific grant and consultation and cooperation agreement negotiations between the Department and states. The Department will give priority to grant requests from states with sites recommended for characterization. The Department currently is evaluating whether the FY 1984 request contains sufficient funds for these more focused efforts, as well as continued site characterization activities for a second repository. The WIPP budget request in FY 1984, which is included in the Defense Waste & Byproducts Management budget, includes $1.1M for the state of New Mexico's Environmental Evaluation Group for independent environmental, health, and safety reviews. This group provides independent peer review of all WIPP planning, design, and operations planning to ensure the health and safety of the citizens of New Mexico.

QUESTIONS SUBMITTED BY SENATOR HATFIELD

Tax Credits

Question: In the FY 83 budget, DOE repeatedly referred to the fact that tax credits will assist the private sector development of solar and renewable technologies and reduce the need for federal spending for R&D. What is your position on the continuation and extension of tax credits for alternative energy technologies?

Answer: As you know the tax credits are not scheduled to expire until 1985. We therefore have time to collect more information about the economic benefits of the credits before developing a recommendation on whether to extend them. I have asked those organizations which support the extension of the credits to provide me with information that explains their effects. I expect that these and other analyses will present a favorable case for extending the credits, but I will wait for the results before reaching a final conclusion. I must point out that although DOE makes recommendations to the Treasury Department on these issues, the final decision rests with Treasury.

R&D Priorities

Question: At the same time that we are cutting out civilian R&D programs -- Germany, Japan, and France are increasing substantially their research budget for energy. The new multibillion dollar business to produce and market renewable energy systems, and more energy efficient products could be lost to our foreign competitors. Our lack of federal commitment seems to be short-sighted policy that truly threatens our position in the world markets. Are you concerned?

Answer: Maintaining the U.S. position in world markets is a very complex economic issue that extends far beyond energy policy. As you know, the Administration carefully is reviewing U.S. trade policy and the effect of our allies' policies on the U.S. economy.

U.S. industry historically has been an effective and efficient producer and marketer of consumer goods; the U.S. can expect to continue to be a leader in technology innovation and production. This Administration's R&D programs recognize the strength of private enterprise and therefore emphasize generic research on high risk, long term technologies. The Administration also recognizes that the U.S. and its allies are experiencing structual changes in their economies. We regularly give careful consideration to our allies' policies and activities and their effects on the U.S. trade position as part of our continuing review of U.S. energy R&D policy.

ATOMIC ENERGY DEFENSE PROGRAMS

Question: Funding for energy defense now accounts for about 60% of the budget. Nuclear defense activities have nearly doubled since FY 81, from $3.5 billion to nearly $7 billion in the FY 84 request. Although these programs are driven by DOD budget requirements and priorities, the Committee is concerned that all of these tremendous increases in DOE may not be fully justified or necessary.

--Last year, Congress increased defense programs by $1 billion and your defense programs personnel expressed satisfaction with the increase -- and yet I understand that you are now developing a large FY 83 Supplemental request which contains most of the FY 83 Congressionally imposed savings.

What is the status of this Supplemental?

What changes have occurred since late in December to justify these increases with half the year behind us?

Answer: Recently the Department requested Office of Management and Budget (OMB) approval to send to Congress FY 1983 supplemental budget requests for Atomic Energy Defense Activities. As of this date no approvals have been received from the OMB.

These requests included $30.0 million of L Reactor Upgrade at Savannah River. During last year's testimony before the Armed Services Committee on the FY 83 budget, the Department identified the potential for a $30.0 million increase in the operating funded portion of the project for upgrading the L Reactor. Testimony provided last year before the Senate Armed Services Committee is provided for your information. Our most current estimate indicates that $20.0 million may be sufficient. As progress on this new initiative develops and definition of funding requirements are further refined, adjustment of our supplemental request to Congress may have to be considered.

SENATE ARMED SERVICES COMMITTEE FY 83 BUDGET HEARING

L REACTOR COST ESTIMATE

Senator WARNER. What has been the increase in total estimated cost for startup of the L Reactor since the program was initiated in fiscal year 1981?

Mr. ROSER. The effort to upgrade L Reactor to the equivalent status of the three operating reactors at Savannah River began in fiscal year 1981. At that time, the preliminary cost estimate for the L Reactor upgrade was $184 million. The total estimated cost for construction was $115 million and other project-related costs were estimated at $69 million.

In December 1981, the total estimated cost for construction was revised to $134 million and the operating costs for other project-related expenses were reduced to $50 million, while the total estimated cost remained at $184 million.

A proposed firm L Reactor upgrade cost estimate became available on March 30, 1982. This estimate is still under review within DOE; however, Defense Programs expects to manage capital cost within the $134 million TEC identified in December 1981. Other project-related operating costs which were shown as $50 million in December 1981 are presently estimated to be approximately $80 million.

This $30 million cost increase is primarily due to incremental increases in a number of areas of the work associated with preparation of L Reactor for restart. The areas of increase are:

	Millions
Additional testing and checkout of systems and subsystems	$4.5
Training of reactor operators	5.5
Repairs to railroads	1.2
Charge and discharge machine renovation and repair	2.2
Disassembly basin repair and renovation	4.2
Heavy water purification system repair and renovation	3.0
Electrical cable replacement	2.0
Repair valves and piping for cooling water, domestic water and sanitary sewer systems	3.2
Motor control repair/replacement	0.6
Total	26.4

The incremental increases resulted from the detailed inspection and testing that occurred in L area between October 1980 and January 1982. In addition, items recently identified by detailed engineering tests are:

	Millions
Remove asbestos insulation	$0.4
Dismantle powerhouse remains	.3
Remove residue from reactor tank	.8
Replace 600 transducer valves	.5
Replace drainline to retention basin	1.6
Total	3.6

Issuance of a firm cost estimate, an updated schedule for the L reactor upgrade, and the project management plan is planned for May 1982.

Two supplementals totaling $39.2 million were requested for the Weapons Activities Plant and Capital Equipment Appropriation to support weapons production and delivery schedules. One request was for a $18.3 million addition to existing production facilities at the Pinellas Plant. Since the submission of our FY 83 budget, several events have occurred that will require increased workload and floor space. For example, required modifications to some neutron generators increased direct man hours by 50%, and a decrease in the number of weapons scheduled for retirement requires additional replacement of limited-life components.

The second supplemental funding requirement of $20.9 million for Weapons Activities related to production facilities for the PEACEKEEPER (MX) warhead. As you are aware, Congress has held up action on the PEACEKEEPER missile system until the recommendations of the Scowcroft Commission have been submitted for Congressional approval. The DOE has maintained the ability to support the initial deployment plans of the Air Force; however, failure to achieve substantial FY 83 progress on the PEACEKEEPER warhead production facilities will foreclose the Department of Energy's option of supporting the Department of Defense Initial Operational Capability schedule. The FY 83 budget request for $60 million was based upon our commitment to meet the 1986 IOC date, and that an additional $20.9 million would be provided in FY 82 in addition to the $9.1 that was appropriated. Our FY 82 supplemental request for $20.9 million was not approved by Congress. The additional $20.9 million will be required in FY 83 if we are to maintain the required schedule for the warhead. Public Law 97-377 appropriated $60.0 million for FY 83 but prohibits DOE from obligating PEACEKEEPER warhead capital until"... expenditures on warhead production facilities are consistent with Congressional action on the MX missile system." On February 15, 1983, DOE requested the Congressional Committees to release $40.0 million of the $60.0 million of FY 83 funding. In anticipation of a favorable decision, the remaining $20.0 million will be required in FY 83 in addition to $20.9 million in supplemental funding.

Clinch River Breeder Reactor

Question: Is one of the "alternative funding proposal" options simply to take the project off-budget?

Answer: DOE and the Breeder Reactor Corporation are evaluating a range of alternative financial options for funding completion of the Clinch River Breeder Reactor Plant (CRBRP) project. These options would make it possible to bring varying levels of private sector financing to the CRBRP. Our objective is to obtain the maximum possible private sector financial participation for project completion. Preliminary indications are that off-budget federal financing is not the most viable approach, and that some mechanism of actual private investment in the project to reduce federal outlays has the greatest potential for meeting project requirements. The Department's report to Congress on March 15, 1983, will discuss the range of options that were considered during its deliberations.

Question: On page 8, you state that "If we do not proceed with Clinch River, we will have to evaluate which of these efforts (in the base breeder program) must continue and at what levels."

Please provide for the record an indication of program elements in the base program which will be reduced or eliminated.

Answer: Individual research and development requirements in the Clinch River Project fall into two categories: (1) those unique to the specific requirements of the Clinch River Project, or (2) those in common with the base technology program. Research and development unique to the Clinch River Project is funded by the Clinch River Project. There are, within the base technology program, a total of 96 individual development requirement specifications. These are tasks funded by the base program, the results of which are needed both by the base program and by the Clinch River Project. These individual activities are in the areas of systems and component development and testing, reactor safety, physics, fuels, and structures. Important examples are proof of fuel absorber and blanket performance, core restraint and seismic design, system containment integrity, instrumentation and control, safety design and regulatory issues, and effectiveness of safety systems. If we do not proceed with Clinch River, program elements in Category (1) will be eliminated and the remainder of the base technology program will be evaluated in light of overall program objectives.

Clinch River Site Preparation

Question: Please outline your involvement in obtaining NRC authorization to proceed with Clinch River site preparation.

Answer: The Department of Energy, along with Project Management Corporation and the Tennessee Valley Authority, is an Applicant seeking authorization from the Nuclear Regulatory Commission to construct and operate the Clinch River Breeder Reactor Plant (CRBRP). Accordingly, the DOE office of General Counsel, as Counsel to the Assistant Secretary for Nuclear Energy and the CRBRP Project Office, has represented the Department's interest in all phases of the licensing process, including the project's requests for authority to begin site preparation activities.

CRBRP sought authorization from the NRC under 10 CFR 50.12 to begin site preparation activities. In each case, the Office of General Counsel represented the Department before the Commission. After the Commission granted the authorization in August 1982, the Intervenors in the proceeding, the Natural Resources Defense Council and the Sierra Club, filed suit in the United States Court of Appeals for the District of Columbia, seeking to stay the Commission's authorization. DOE's Office of General Counsel, in conjunction with the Department of Justice, continued its representation of the Department's interests in proceeding with site preparation activities.

The Office of General Counsel also represents DOE before the NRC's Licensing Board in connection with the application to construct and operate CRBRP, which also bears on site preparation. On February 28, 1983, the Licensing Board, in a Partial Initial Decision on the application for a Construction Permit, granted a Limited Work Authorization under 10 CFR 50.10(e). Site preparation is one element of the authorization granted by that action.

Newly-Instituted International Nuclear Cooperation

Question: On page 3 of your statement, you mention a number of new cooperative activities between DOE and foreign countries. Please provide the Committee with an explanation of the newly-instituted nuclear cooperation which is mentioned.

Answer: During 1982, the Department of Energy entered into international nuclear R&D agreements to cooperate with Canada in radioactive waste management, with EURATOM in radioactive waste management and safeguards, with Japan in fast reactor physics and safety, with Switzerland in fast reactor fuels, and with the Nuclear Energy Agency in decontamination of nuclear power reactors.

The waste management R&D agreement with Canada enables us to exchange information, personnel, equipment, materials, instruments, and components for testing; to conduct visits and seminars; and to establish joint projects. The technical areas involved include preparation and packaging of waste, decontamination and decommissioning, surface and subsurface storage, characterization of geologic formations, disposal in geologic formations, transportation requirements, operational considerations, environmental and safety considerations, and public acceptance issues. The waste management agreement with EURATOM is similar in nature except that the scope of technical cooperation is limited to characterization of waste forms and disposal in geologic formations.

The agreement with EURATOM in nuclear materials safeguards R&D provides for exchange of information, equipment, components, computer codes, and visits for the development of safeguards techniques, which can contribute to nuclear non-proliferation.

The agreements with Japan establish two joint projects in certain aspects of fast breeder reactor development. The cooperation in physics involves joint planning, conduct and analysis in a large heterogeneous core critical experiments benchmark program called JUPITER II at Argonne National Laboratory. The cooperation in safety involves the joint development and validation of a safety analysis computer code by means of exchange of safety information and the application of experimental data generated through in-pile and out-of-pile measurements.

With Switzerland, the objective is to compare the behavior of Swiss- and US-developed mixed uranium-plutonium oxide fuels for fast breeder reactors by means of irradiation of these fuels in the Fast Flux Test Facility at Richland, Washington.

Cooperation under the Nuclear Energy Agency provides for US participation in an international demonstration project of decontamination techniques to be applied to the 60 megawatt Agesta reactor located near Stockholm, Sweden. These techniques were developed by laboratories in Sweden, Switzerland, the Federal Republic of Germany, and the United Kingdom. DOE participation was arranged in the interest of supporting US industry.

In general, we find our international cooperation to be valuable for a number of reasons. First, we gain broader, deeper and far more rapid access to foreign technology than would have been the case absent the cooperative agreement; this is particularly so in the case of our waste management cooperation with EURATOM. Second, by task-sharing we can economize on time and resources including money, manpower and facilities; this would be characteristic of the three project agreements with Japan and Switzerland. Third, we often find foreign experience to be useful in validating the results of our own experiments; the safeguards cooperation with EURATOM furnishes an excellent example. Fourth, we often find that information obtained on foreign developments in nuclear technology to be helpful in responding to requests for information from other parts of the United States Government, industry, and the general public. Finally, the systematic cooperation among scientists of various nations has proven to have a synergistic effect beneficial to all parties to the cooperation.

Question: Does this include an agreement on the larger demonstration breeder, and if so, what is the status of this agreement?

Answer: None of the foregoing agreements directly contemplate international cooperation in a large breeder reactor demonstration, although indirectly the hoped-for results would tend to support the development of both a large breeder reactor and its associated fuel cycle.

Status of International Agreement for FMIT

Question: Give us a status report on the cooperative agreement in support of the FMIT project at Hanford.

Answer: DOE is now attempting to conclude the $200 million FMIT project as an international cost-shared venture among the US, the European Community (EC), Japan and Canada under the auspices of the International Energy Agency (IEA) of the Organization for Economic Cooperation and Development. In September, 1982, the IEA Fusion Power Coordinating Committee agreed to recommend to the IEA Committee for Research and Development (CRD) that a Senior Advisory Panel on the role of materials research in the development of fusion energy be formed to answer four questions:

I. What is the role of materials research in fusion:
II. Is the FMIT the appropriate route to take?
III. Can FMIT be built as planned?
IV. How can FMIT be conducted as an international project?

In October the CRD endorsed the recommendation to establish the Senior Advisory Panel. The Panel, composed of seven senior technologists from the US, Japan, EC, and Canada, first met in December, and established various experts groups to address serially the first three questions. An international ten-member "project review team" also visited Hanford the week of January 30 to see if FMIT could meet its performance objectives, cost projections and construction timetables. The Senior Advisory Panel met March 15-17 and, working closely with the experts groups, concluded that the answers for the first three questions were all positive.

The CRD Secretariat is now consolidating from the members of the Senior Advisory Panel their lists of features that they feel the FMIT Agreement should have, and thoughts on questions IV. The Senior Advisory Panel next meets June 17 to review the report which is to be submitted in July to the Fusion Power Coordinating Committee for its consideration. The Fusion Power Coordinating Committee is expected to receive a positive report on the technical issues. The key remaining question is whether the interested governments will decide to make a financial committment to this project at this time.

Magnetic Fusion

Question: The FY 1984 request proposes to allocate $467 million, an increase of about $20 million, for the magnetic fusion program. Last year, the Department proposed a reduction in the program -- does this signal a shift towards additional support for this energy research program?

Answer: The budget request of $467 million represents the Administration's continued support for the Magnetic Fusion Energy program's goal of developing the scientific and technological information required to design and construct the magnetic fusion power system. The funding request, which amounts to an increase of about 4.5 percent, provides the cost of living increases required by the ongoing scientific and technology base program elements as well as allowing for construction and hardware fabrication work to continue of the Mirror Fusion Test Facility project.

Question: Most of the funding is proposed for operating expenses and there is very little construction activity. What effect or impact will these changes have on the progress of the fusion program?

Answer: The distribution of funds between operating and construction as reflected in the FY 1984 budget request, is consistent with the program plan to demonstrate the scientific and engineering feasibility of fusion. The decrease in construction essentially reflects the fact that several projects recently have been completed. As these projects are completed, additional operating funds are required to operate, maintain, and improve these new devices. The information generated from the operation of these new devices subsequently will provide input to the design of more advanced facilities. In addition, the funding for construction of the Mirror Fusion Test Facility - B is decreased $10.0 million as the project nears the completion phase.

Funding for Barnwell

Question: The FY 83 Continuing Resolution provides funds to complete by July 31 the Safeguards demonstration at the Barnwell facility.

Question: Are you maintaining the schedule of phasing-out federal activities by July 31?

Answer: In accordance with the terms of the FY 1983 continuing resolution, all federal funds supporting the Safeguards and Security work will terminate by July 31, 1983.

Question: Have any funds been requested in any part of the FY 84 budget for any activities at the Barnwell facility?

Answer: No funds have been requested in the FY 84 budget for any activities at the Barnwell facility.

Question: How much funding was requested by the Department initially from OMB to support the Barnwell facilities? ($200-$300 million was requested but dropped by OMB) What was the purpose for this large request to OMB?

Answer: As stated above, no funds were requested for further support of Barnwell's R&D program in the FY 1984 budget. BA of $250 million initially was requested from OMB for the eventual purchase of plutonium recovered at Barnwell or some other reprocessing plant in the future. This purchase was one of a number of options being considered to encourage reprocessing commercial spent reactor fuel and to provide contractual protection against major future policy changes while providing an alternative supply of plutonium for the breeder program. Actual expenditure of such funds would not begin until plutonium was delivered.

FY 83 Deferrals for Solar and Conservation

Question: There have been discussions of some FY 1983 deferrals being proposed by DOE - what is the status of the solar and conservation deferrals?

Answer: The solar and conservation deferrals are currently in the final review stage at OMB. On March 31, 1983 the cognizant Congressional Committees were informed of DOE's intent to defer $5M in the Solar Program, (Solar Ponds $2M, and 2nd Small Communities Experiments $3M) and the conservation program intends to defer $4.5M, ($3.0 in Technology and Consumer Products, and $1.5M in the National Appropriate Technology Assistance Service).

Power Marketing Coordination

Question: Explain the proposed FY 84 reduction for the Office of Power Marketing Coordination. Is there a proposed reduction in the responsibilities of the Office?

Answer: The staffing in the FY 1984 Budget Request for Power Marketing Coordination is increasing from a total of 9 FTE's in FY 1983 to a total of 10 FTE's in FY 1984. However, since the submission of the FY 1984 Budget Request, the Bonneville Power Administration and the Western Area Power Administration report directly to the Office of the Secretary, and not through the Assistant Secretary for Conservation and Renewable Energy. They will provide their own liaison staffs in Washington. The remaining three Power Marketing Administrations will continue to report to the Assistant Secretary. The impact of these changes on the scope of the Office of Power Marketing Coordination is being reviewed for possible change in functions and staffing.

DEPARTMENTAL ADMINISTRATION

PREPARED STATEMENT FOR THE RECORD

Senator COCHRAN. We would also like to include in the record, if there is no objection, the prepared statements relating to the management of the Department and the various other offices which come under the administrative umbrella of the Assistant Secretary for Management and Administration.

Those statements will be made part of the record at this point, followed by a series of questions prepared by the subcommittee staff.

[The information follows:]

STATEMENT OF MARTHA O. HESSE, ASSISTANT SECRETARY, MANAGEMENT AND ADMINISTRATION

Mr. Chairman, Members of the Committee:

I am Martha O. Hesse, Assistant Secretary, Management and Administration of the Department of Energy. I appreciate the opportunity to appear before you today in support of the FY 1984 budget request for the Departmental Administration Appropriation, and Technical Information Services, In-House Energy Management, and non-defense Plant Engineering and Design requested in the Energy Supply Research and Development Appropriation. The total fiscal year 1984 request for these activities is $171.4 million.

The Departmental Administration request totalling $141.9 million includes General Management and Support Activities, and the Energy Supply Research and Development Appropriation totalling $29.5 million covers program costs for Technical Information Services, In-House Energy Management, and non-defense Plant Engineering and Design.

Testimony will be presented by other principal spokesmen for six of the major areas within Departmental Administration, followed by my testimony for the balance of the activities. With me today are R. Tenney Johnson, General Counsel; George Bradley, Principal Deputy, Office of the Assistant Secretary for International Affairs; Robert C. Odle, Jr., Assistant Secretary, Congressional, Intergovernmental, and Public Affairs; J. Hunter Chiles, III, Director of the Office of Policy, Planning, and Analysis; James R. Richards, the Inspector General; and Rosslee G. Douglas, Director of the Office of Minority Economic Impact. Each will address the budgets for their respective offices.

First, however, I will present a brief overview of the budget request for fiscal year 1984. The $171.4 million request includes $124.8 million for salary and related expenses, $110.5 million for support services, $14.4 million for In-House Energy Management, $14.1 million for Technical Information Services and $1.0 million for Plant Engineering and Design. Also included is $116.2 million for Cost of Work for Others and $209.6

million in offsetting revenues. This concludes my introductory remarks. Mr. Johnson is prepared to speak to the activities of the Office of I will now speak to the balance of the functions included in the Departmental Administration Appropriation, and the Energy Supply Research and Development Appropriation budget requests. Departmental Administration includes Management and Administration, the Office of the Secretary, five multi-purpose Operations Offices, and the financial accounts of Cost of Work for Others and Miscellaneous Revenues. Funding in the Energy Supply Research and Development Appropriation includes Technical Information Services, the In-House Energy Management Program, and Plant Engineering and Design.

MANAGEMENT AND ADMINISTRATION

Management and Administration includes funding for personnel salaries and benefits for the Procurement and Assistance Management Directorate, the Office of the Controller, and the Office of Administration. The request also includes support service costs for all headquarters personnel. Of the $116.2 million requested in FY 1984, $36.5 million is for the salaries of a total of 950 full-time-equivalents and $1.9 million for related travel. The support services request of $77.8 million provides for Headquarters space rental, supplies, transportation, communications, printing and security, and purchase of capital equipment.

OFFICE OF THE SECRETARY

The request for Office of the Secretary includes $927 thousand for salary, expenses and travel costs.

OPERATIONS OFFICES

Five of the eight multi-purpose Operations Offices are also funded within Departmental Administration in the amount of $77.5 million; $55.5 million is for salaries and related expenses; $1.9 million for travel expenses; and $20.1 million for space rental, supplies, transportation, communications, and related support services and capital equipment for the Operations Offices. This estimate funds staffing of 1,457 full-time-equivalents. These five multi-purpose Operations Offices perform a wide variety of program execution and project management functions throughout the country. The principal functions are technical direction or project management of nuclear research and development, energy research and development, and defense programs activities; contract administration and day-to-day management oversight of Government-Owned Contractor-Operated facilities; design, engineering and construction management; procurement; health, safety and environment oversight; property and real estate management; contractor industrial relations; financial management; and management of related support services. The other three Operations offices primarily support Defense Activities and are funded by the Atomic Energy Defense Appropriations.

COST OF WORK FOR OTHERS AND MISCELLANEOUS REVENUES

Cost of Work for Others covers expenses for materials and services to non-Federal organizations when such products or services are not readily available from the private sector. The FY 1984 estimate is $116.2 million. The Department will receive an estimated $135.2 million in Miscellaneous Revenues as reimbursements for this work. Revenues estimated at $74.4 million are also earned from the sale of by-products, such as reactor steam and special nuclear materials. Since these are by-products, there is no cost of work incurred.

PLANT ENGINEERING AND DESIGN

The Plant Engineering and Design request of $1.0 million covers funding of advanced Architect - Engineering services in support of proposed non-defense construction projects considered critical to the timely accomplishment of the Department's mission. The funding will allow selected projects to proceed directly from conceptual design into Preliminary and Definitive design and permit us to provide better cost and schedule estimates to Congress.

TECHNICAL INFORMATION

The Technical Information Services Program, managed by the Technical Information Center in Oak Ridge, Tennessee, is a centralized technical information service for the Department's program managers and contractors.

The program supports the Department's energy research and development effort by collecting, managing, controlling and disseminating scientific, technical and engineering energy information. The FY 1984 budget request for the Technical Information Services Program is $14.1 million, which includes $13.3 million for operating expenses and $0.8 million for purchase of capital equipment. This request will support 170 full-time-equivalents.

IN-HOUSE ENERGY MANAGEMENT

The FY 1984 request for In-House Energy Management is $14.4 million. The In-House Energy Management Program represents a continuing investment to improve the energy efficiency of DOE buildings, facilities and operations. This program continues the retrofits required under the National Energy Conservation Policy Act of 1978 and Executive Order 12003 of July 20, 1977. The program of energy saving retrofits proposed today has a payback period of 1.9 years with an annual energy saving to the Department of 315,000 barrels of oil equivalent. With this short payback period the program helps to reduce utility costs. Proposed funding also continues the program of conservation surveys to identify future retrofit projects, central plant studies to evaluate the economic feasibility of fuel conversions and cogeneration of electricity, and any other conservation methods that will reduce overall energy consumption within the Department. Because DOE is the Government's second largest user of energy, the potential for savings is substantial.

Mr. Chairman, that concludes my portion of this presentation. My colleagues and I will be happy to respond to any questions you or the Committee members may have.

BIOGRAPHICAL SKETCH OF MARTHA O. HESSE

Martha O. Hesse was named Assistant Secretary for Management and Administration, U.S. Department of Energy (DOE) on November 10, 1982, pursuant to a recess appointment granted by President Reagan. She was confirmed for the position by the Senate on December 8, 1982.

In this position, Ms. Hesse serves as the Department's chief administrative officer, reporting directly to Secretary of Energy Donald Paul Hodel. Her duties, in addition to administrative and personnel management, include responsi-bility for contracting and procurement, and the financial and accounting activities of the Department.

Before joining DOE, Ms. Hesse was Executive Director of the President's Task Force on Management Reform, located in the Office of Management and Budget.

From February 1981 until her White House assignment, Ms. Hesse was Associate Deputy Secretary of Commerce, where she provided direct support to the Deputy Secretary in administering the overall operations of the Department and resolved major policy and program operation issues that arose between the bureaus of the Department.

A prominent Chicago businesswoman, Ms. Hesse in 1969 became director and chief operating officer of SEI Information Technology in Chicago. As cofounder of this professional services company, she held key management positions and directed the company's business activities.

From 1966 to 1969, Ms. Hesse was Director of the Data Management Division, American Hospital Association. From 1964 to 1966, she was a research analyst with the Blue Shield Association.

Ms. Hesse, 40, attended the University of Iowa majoring in psychology, and received an MBA (the Executive Program) from the University of Chicago in 1979. She currently serves as Vice Chairman of the Dean's Fund at the University of Chicago's Graduate School of Business.

STATEMENT OF R. TENNEY JOHNSON, GENERAL COUNSEL

Mr. Chairman and Members of the Committee:

I am pleased to appear before you today to discuss the fiscal year 1984 budget request for the Office of General Counsel.

THE OFFICE OF GENERAL COUNSEL

Before discussing our budget request, I would like to summarize the responsibilities of the Office of General Counsel. Viewing our responsibilities from the broadest perspective, we support, rather than run, programs, with the exception that we conduct the Department's patent and standards of conduct programs within the Office of General Counsel. We perform the traditional lawyer's functions for the Secretary and the Department, with the exception of the Federal Energy Regulatory Commission. These functions include legal counseling, legislative drafting, conducting rulemakings, providing legal advice to the negotiation of contracts, and conducting litigation. I cite as an example worthy of special note the legal work we have and continue to perform with respect to the Nuclear Waste Policy Act of 1982. We performed legislative drafting services at the request of Members, we are now very heavily involved in the wide array of efforts necessary to implement this landmark legislation, and, should litigation arise, we will be involved in that as well. Our FY 1984 budget request is based on our continuing to perform these traditional legal functions.

A few examples will serve to illustrate the range of Department activities that result in considerable legal work. In the area of litigation, we continue to make progress towards bringing the oil pricing enforcement program to a satisfactory conclusion. In the past year, the number of pending cases has decreased by over 60, bringing our caseload to 357. We have litigated or settled successfully a number of crude oil overcharge cases resulting in awards of tens of millions of dollars, and recently won a ruling in an overcharge case establishing a $1 to $2 billion liability. Moreover, the court of appeals has upheld the Department's position on the major legal issue in another crude oil case, involving about $1 billion in alleged overcharges, which is presently being litigated before the agency.

In addition to this enforcement litigation, the Office of General Counsel represents the Department in numerous general litigation matters. Of these, perhaps the most widely covered by the media are the radiation injury claims against the Government. We also litigate cases before State public utility commissions and the Federal Energy Regulatory Commission, where we represent the interests of DOE facilities and those of other Federal Government agencies as purchasers of electricity. DOE generally supports positions that are consistent with sound ratemaking principles and that would minimize electricity costs to Federal facilities. We estimate that annual cost savings of approximately $6.5 million have been achieved for DOE and other Government agencies in these ratemaking proceedings.

During 1982, we assisted in continuing to implement the President's program on regulatory reform by minimizing regulatory burdens imposed on the public and industry. As examples: we helped to develop the Department's proposed determination that mandatory Federal energy efficiency standards for eight major household appliances were not cost effective or warranted, and prepared the final rules that were issued for two of those eight appliances; assisted in reducing by at least $300 million the estimated cost to utilities for complying with Federal building energy audit and other conservation requirements; took steps to reduce the burden of reporting requirements; and completed a comprehensive review of all outstanding or proposed regulations which led to the elimination or modification of many of them.

In nuclear-related activities, in addition to the work related to the Nuclear Waste Policy Act of 1982 that I mentioned earlier, the Office of General Counsel was instrumental in obtaining Nuclear Regulatory Commission authorization to begin site preparation for the Clinch River Breeder Reactor program and participated in several judicial actions challenging that project. We also provided leadership for a task force that developed a legislative proposal to reform the nuclear regulatory and licensing process.

FY 1984 BUDGET

The FY 1984 appropriations request for the Office of General Counsel is $11,809,000. Our budget request would provide for a level of 226 total full-time equivalents.

This budget request is the result of a very detailed examination of our responsibilities and workload. The requested staffing level is the lowest level consonant with performing our legal responsibilities in a satisfactory manner.

Mr. Chairman, that concludes my remarks. I will be happy to respond to any questions you or the subcommittee Members may have.

BIOGRAPHICAL SKETCH OF R. TENNEY JOHNSON

R. Tenney Johnson was confirmed General Counsel for the U.S. Department of Energy (DOE) on June 2, 1981. As DOE's General Counsel, Mr. Johnson is responsible for the Department's legal programs and policies with the exception of those related to the Federal Energy Regulatory Commission, which maintains a separate legal staff.

Prior to service with DOE, Mr. Johnson was a partner in the Washington, D.C., law firm of Sullivan & Beauregard. He joined that organization in 1978.

Before entering the private sector, Mr. Johnson had served with various Federal agencies and on special Government committees since 1959. His agency appointments included service as a member of the Civil Aeronautics Board (CAB), 1976-77; General Counsel with the Energy Research and Development Administration (ERDA), 1975-76; General Counsel at the National Aeronautics and Space Administration, 1973-75; General Counsel for CAB, 1970-73; Deputy General Counsel for the Department of Transportation (DOT), 1967-70; Deputy General Counsel for the Department of the Army, 1963-67; and attorney in the Office of the General Counsel, Department of Defense, 1959-63.

Mr. Johnson was Chairman of the Organizational Integration Working Group, DOE Activation Task Force, from June until September 1977. During the period 1975-79, he served as U.S. CoChairman, U.S./U.S.S.R. Joint Working Group on Intellectual Property, U.S./U.S.S.R. Agreements for Cooperation. From 1970-72, he served as Consultant on Patent Policy and Indemnification against Unusually Hazardous Risks, Commission on Government Procurement.

He received an A.B. degree with high honors from the University of Rochester in 1951 and an LL.B. degree from Harvard Law School in 1958. From 1954 to 1955, Mr. Johnson engaged in graduate study in English literature at Trinity College, Dublin (Ireland). The latter undertaking was on a Phi Beta Kappa Fellowship for Travel and Study in Europe. He served as a lieutenant in the U.S. Navy from 1951 to 1954.

Mr. Johnson is an active member of the District of Columbia Bar, the American Bar Association, and the Federal Bar Association. His honors include the Distinguished Service Award, presented by ERDA in 1976; the Meritorious Achievement Award by DOT in 1968; and the Exceptional Civilian Service Decoration by the Department of the Army in 1967.

A native of Evanston, Ill., but now a resident of Bethesda, Md., Mr. Johnson is married and has three children.

STATEMENT OF JAMES R. RICHARDS, INSPECTOR GENERAL

Mr. Chairman, I would like to express my pleasure in having the opportunity to address the members of this Subcommittee. I am James R. Richards, the Inspector General of the Department of Energy (DOE).

RESPONSIBILITIES

The statutory responsibilities of the IG, as stated in Section 208, Public Law 95-91, are to detect and prevent fraud and abuse and to promote economy and efficiency in the programs and operations of DOE. These responsibilities relate to the work of over 17,000 employees directly employed by the Department, to about 115,000 people working for DOE contractors at Government-owned, contractor-operated facilities, and to the activities of employees of many thousands of other contractors and grantees of the Department.

The Department of Energy is a complex and multi-missioned Department with missions varying from the assembly of nuclear weapons to the funding of energy audits for schools and hospitals. Further, the Department is second only to the Department of Defense in the amount of its procurement activity. Thus, the audit, inspection, and investigative requirements of DOE are extensive and varied in scope and complexity.

ORGANIZATION

- Audits, Inspections, Investigations -

The Office is organized in three divisions with three Assistant Inspectors General. The Office of Audits functions as the internal auditing arm for the Department and performs the following types of audits: financial and compliance, efficiency and economy, and program results. The Office of Investigations is responsible for the detection and prevention of fraud and abuse. The Office of Inspections is responsible for inspection of DOE's scientific and technical programs and operations. In addition, an Office of Executive Director performs administrative, personnel, policy, planning, and management information functions for the Inspector General.

Last spring the Office of Inspector General assumed 46 audit positions that formerly reported to DOE field offices and total responsibility for auditing the programs and operations of the Department. At that time we also reorganized our audit organization and established a field audit organization. Our field structure is now in place and is composed of an Eastern and Western Regional Office with 11 satellite offices, and the Washington Audit Office, located in Germantown, Maryland. These offices contain audit, investigative and support personnel.

Beginning in FY 1983, the responsibility for contract auditing was reassigned from the Office of Procurement to my office, and funds were reprogrammed to carry out that function. The Defense Contract Audit Agency (DCAA) performs the majority of these audits for the Department.

ACCOMPLISHMENTS

Our Calendar Year 1982 Annual Report to the Secretary and the Congress is nearing completion and will be submitted to you by March 31, 1983. In the future, as required by our recently amended statute, we will submit a semiannual report. The Calendar Year 1982 report will describe in detail our accomplishments last year. Our audit and inspection reports have continued to contain recommendations that have significant dollar impacts. For example, in an audit of the ISABELLE Project we recommended actions that could lead to recoveries or reduced expenditures of about $2.35

million. In an inspection of the High-Level Nuclear Waste Immobilization Program we determined that the Department of Energy could avoid at least $173 million in costs for additional high-level defense waste storage facilities by proceeding expeditiously to immobilize current inventories. Further, our investigative efforts have continued to focus on suspected fraud and abuse. During 1982 these efforts resulted in 6 indictments, 10 cases resulting in convictions, and 12 cases resulting in disciplinary action.

FUNDING LEVEL

The following is a description of the request for FY 1984:

	FY 1984 Budget Request
Salaries/Other Compensation	$7,249,000
Benefits	801,000
Travel	520,000
Support/Services	150,000
DCAA	5,950,000
	$14,670,000

The above includes funding for DCAA audits and the pay cost supplemental and medicare increase. In FY 1984 we are requesting 180 FTE's.

I appreciate the opportunity to appear today before this Subcommittee and will be pleased to respond to any questions you may have.

BIOGRAPHICAL SKETCH OF JAMES R. RICHARDS

James R. Richards was nominated by the President on May 15, 1981, and confirmed by the Senate on September 21, 1981, as the Inspector General for the U.S. Department of Energy (DOE). In this position, he is responsible for the coordination, supervision, and management of investigations and audits of all Departmental activities, including those of the Federal Energy Regulatory Commission, to ensure honest and efficient management.

Mr. Richards has served as General Counsel and Vice President of the National Legal Center for the Public Interest, in Washington, D.C., since September 1980. His major responsibilities (at the Center) have included the coordination of legal activities of six federated public interest law firms located throughout the country. From July 1977 to August 1980, he was Vice President and Legal Director of Capital Legal Foundation, also located in Washington, D.C.

During the period 1973 to 1977, Mr. Richards served with the U.S. Department of the Interior as Director of the Office of Hearings and Appeals. His responsibilities included the management of five quasi-judicial appeals boards and administrative law judges.

Mr. Richards joined the U.S. Department of Justice in 1969, serving initially as Assistant U.S. Attorney for Colorado and later as Chief of the Buffalo, New York, Organized Crime Strike Force. In 1972, he was appointed area coordinator of the Organized Crime Section in Washington, D.C., responsible for the management of major investigations and trials throughout the country. Prior to this he engaged in private practice of law for three years.

From 1963 through 1965, he was Legislative and Executive Assistant to U.S. Senator Peter H. Dominick. Prior to this he served two years as Colorado Assistant Attorney General.

Mr. Richards received a B.A. degree in history and English from Western State College in 1955. He was awarded an L.L.B. degree in 1960 from the University of Colorado School of Law.

He is a member of the American, Washington, D.C., Federal, and Colorado Bar Associations.

Born in Kinderpost, Mo., Mr. Richards currently resides in Arlington, Va.

STATEMENT OF J. HUNTER CHILES III, DIRECTOR, OFFICE OF POLICY, PLANNING, AND ANALYSIS

Mr. Chairman, Members of the Subcommittee:

I appreciate the opportunity to appear before you today to discuss the FY 1984 budget request for the Department of Energy's Office of Policy, Planning, and Analysis (PPA).

PPA'S ROLE AND RESPONSIBILITIES

The Office of Policy, Planning, and Analysis serves as principal advisor to the Secretary of Energy for formulating and recommending national energy policy. The Office's role has been modified since last year. PPA, instead of having its lead role in DOE policy formulation, now functions as an organization that assures proper oversight and consistency among policy options. Most of its specific policy formulation has been lodged with the appropriate program offices. PPA continues to develop, analyze and recommend major energy policy initiatives and ensures the review and integration of policy proposals developed in the various program areas. The Office also concentrates upon emerging energy issues, forecasts of long-term energy supply and demand, strategic planning issues, analysis of potential policy options, and analytical efforts required for policy development. Other major PPA efforts on behalf of the Secretary include such cross-cutting issues as the coordination and preparation of the biennial National Energy Policy Plan and the Department's long-range strategic planning process. PPA also coordinates the Secretary's participation in the Cabinet Council process by assuring coordinated DOE analysis of the subjects under consideration by the Councils, by contacts with the staffs of other Council members both informally and through issue working groups, and by briefing the Secretary on all relevant facts to assure that he is in a position to make informed decisions on the subject at hand. Finally, PPA is also responsible for advising the Secretary on the development and analysis of legislative proposals to support policy objectives, analyzing and evaluating DOE regulatory proposals for consistency with Departmental policy and their effectiveness in achieving policy objectives, and assist in formulating DOE policy objectives for use of tax incentives, loan guarantees, and other financial incentives.

ACCOMPLISHMENTS

Significant accomplishments include the preparation of the quantitative analyses that were used to quantify the optimum size of the Strategic Petroleum Reserve under varying conditions of uncertainty, which led to the Strategic Petroleum Size Study. Related to another Congressionally mandated effort, PPA is preparing a study of the effects of crude oil decontrol to provide relevant analyses to the Secretary and Administration as they address these problems. The Office is currently working on the National Energy Policy Plan-IV which we plan to provide to the Congress in May and the FY 1985-1989 Strategic Program Planning Cycle for the Department.

FY 1984 BUDGET REQUEST

The FY 1984 request reflects the staffing and budget requirements which are consistent with the reorganization of Federal energy functions. The level of this staff will depend on the energy issues under consideration at the time, the support required by the line organizations as they assume the lead in policy formulation, and the specific areas of expertise required by the issues under consideration at the time.

The requested level of funding is $5,734,000. The FY 1984 request includes funding for two primary program elements---policy analysis and systems studies and program direction. A breakout is shown below.

BUDGET REQUEST

(BA in thousands)

	FY 1984 Request
Policy Analysis and Systems Studies	$ 3,500
Program Direction	2,234
Total	$ 5,734
Total FTEs	35

PPA's request for policy analysis and systems studies, those performed under contract is $3,500,000. This is reflective of the added responsibilities for policy development being shifted to the line organizations. We will place emphasis on the analysis of future energy policy issues, development of new policy initiatives, coordination of these initiatives within the Department and monitoring the implementation of policy decisions within DOE. Program Direction provides funding for salaries, benefits, and travel expenses to support 35 FTE's. The primary functions of the PPA staff are conceptual development and framing of issues and analytical tasks, selection of methods of issue analysis, and policy development. Our FY 1984 budget request of $2,234,000 for Program Direction is based upon energy reorganization.

Mr. Chairman, this concludes my formal presentation. I would be happy to answer any questions you or the members of your Subcommittee might have.

BIOGRAPHICAL SKETCH OF J. HUNTER CHILES III

J. Hunter Chiles III was appointed Director, Office of Policy, Planning and Analysis, U.S. Department of Energy (DOE), on June 1, 1981. In this position, Mr. Chiles is responsible for developing national energy policy, coordinating the analysis and evaluation of policies and programs, and conducting a continuing assessment of the Nation's energy situation. In addition to Mr. Chiles being Director, Office of Policy, Planning and Analysis, he was appointed Special Assistant to the Secretary, U.S. Department of Energy on June 1, 1982, and served concurrently in that position until November 5, 1982.

Prior to government service, Mr. Chiles was chief energy policy planner for Westinghouse Electric Corp. at corporate headquarters in Pittsburgh, Pa. Joining Westinghouse in 1960, he held engineering and management positions of increasing responsibility until his appointment as Director of Strategic Marketing Operations in 1980. As Director, he was responsible for long-range forecasting of energy supply and demand, domestic elec-tricity requirements, and economic trends, as well as corporate support in long-term energy research and de-velopment and analytical predictions concerning the business environment and implications for products and services.

Mr. Chiles is a graduate of Virginia Polytechnic Institute with a Bachelor of Electrical Engineering degree. He received a master's degree in business administration from the University of Pittsburgh and his professional engineer's license in 1968. Mr. Chiles' military service was in the U.S. Army as a guided missile staff officer, supervising maintenance of the Army's missile systems.

He is a recognized authority on the subject of energy and is in demand as a speaker nationally and internationally. In addition, Mr. Chiles has testified on energy matters before many government organizations.

Born in Sharon, Pa., Mr. Chiles currently resides in Fairfax, Va. He is married and has two sons.

STATEMENT OF ROBERT C. ODLE, JR., ASSISTANT SECRETARY, CONGRESSIONAL, INTERGOVERNMENTAL, AND PUBLIC AFFAIRS

Mr. Chairman and Members of the Subcommittee:

I appreciate the opportunity to appear before you today to discuss the FY 1984 budget for the Office of Congressional, Intergovernmental and Public Affairs. This Office has been responsible for developing, managing and ensuring communication of information to the Congress; news media; State, Territorial, tribal and local government officials; other Federal Agencies; consumer, business and citizen organizations; the general public; and for promoting competition in the energy industry.

FY 1983 ACTIVITIES

During FY 1983 this Office's activities are focused on:

- Coordination of Departmental efforts related to the consideration and passage of new and revised legislation;
- Continued efforts to maintain effective communication with the public in order to provide information on energy policy and programs that strengthen the nation's economy and security;
- Promotion of prudent development of Indian energy resources through an interagency contract managed by DOE with the Council of Energy Resource Tribes;
- Coordination of DOE activities with State and local governments as well as consumer-oriented organizations;
- Management of the National Energy Policy Plan IV nationwide public hearing process for developing the Plan as required by law which includes consideration of the views of other levels of government;
- Advocacy of market-based solutions within DOE and analysis of the impacts of Departmental activities.

The Administration's energy policies encourage the efficient production and use of energy by reducing government intervention in energy markets. As many specific energy programs are reduced upon the merger of DOE with another department, the need for extensive Congressional, intergovernmental, consumer and public affairs efforts and competition analysis will diminish as well.

FY 1984 BUDGET REQUEST

My budget request for FY 1984 recognizes these reduced requirements under a merger; therefore, a total of $3.4 million is requested. The funds requested are needed primarily to support 50 full-time equivalent workyears for the Congressional, intergovernmental, public and consumer affairs functions. We consider our Congressional relations activities to be paramount and we will devote over 40 percent of our staff to continue to provide you and your staffs with support.

In the public affairs area, emphasis will be placed on national press relations and agency business with the media; review and control of publications and audiovisual products; and management of agency exhibit activities. Smaller staffs will continue to provide central agency coordination of intergovernmental and consumer activities, while the competition function will be assumed by other energy program officials. The remainder of the request will provide contractual support for public affairs activities. The following table summarizes the FY 1984 request:

	FY 1984 Request (000's)
Public Affairs--Contracts	$ 150
Program Direction	3,250
Total	$3,400

BIOGRAPHICAL SKETCH OF ROBERT C. ODLE, JR.

Robert C. Odle, Jr., was nominated by President Reagan on April 6, 1981, and confirmed by the Senate on May 13, 1981, as Assistant Secretary for Congressional, Intergovernmental, and Public Affairs, U.S. Department of Energy (DOE). In this position, Mr. Odle is responsible for coordinating the Department's legislative programs; activities involving State, local, and American Indian governments; public and consumer affairs programs; and DOE's Office of Competition.

Prior to his current appointment, Mr. Odle was Washington Corporate Affairs Representative for International Paper Co. Joining International Paper in 1976, he specialized in liaison with Federal agencies and departments and represented the company before the Congress on energy, environmental, regulatory, and wage-price issues.

From 1973-76, Mr. Odle served as Deputy Assistant Secretary and Acting Assistant Secretary at the U.S. Department of Housing and Urban Development (HUD). While at HUD, his primary responsibilities involved the financial and operational management of single- and multi-family housing programs and administration of the public housing program.

During 1971-73, Mr. Odle served as Director of Administration for the Committee for the Re-election of the President. He was a Staff Assistant to the President from 1969 to 1971.

Mr. Odle received a B.A. degree in political science from Wayne State University, Detroit, Mich., in 1966, and was awarded a Juris Doctor Degree with honors from the Detroit College of Law in 1969. He is a member of the Delta Theta Phi Law Fraternity and the Michigan and American Bar Associations.

Born in Port Huron, Mich., on February 15, 1944, Mr. Odle currently resides in Alexandria, Va., with his wife, the former Lydia Ann Karpinol. Mrs. Odle is President of the firm of Manarin & Odle Realtors, Inc.

STATEMENT OF ROSSLEE G. DOUGLAS, DIRECTOR, OFFICE OF MINORITY ECONOMIC IMPACT

Mr. Chairman, Members of the Subcommittee:

I am Rosslee G. Douglas, Director, Office of Minority Economic Impact (MI). I appreciate the opportunity to appear before you today in support of the FY 1984 budget request for Departmental Administration.

The responsibilities of MI include advising the Secretary of Energy on the impact of National energy policies, programs, and regulations on minorities; provide technical and management assistance to minority educational institutions and minority business enterprises to increase their participation in energy activities; and to provide direct loans to minority businesses for the development of proposals or bids to the Department. The Office will provide for the full coverage of the activities mandated by Section 641 of the National Energy Conservation Policy Act (Pub. L. 95-619), dated November 9, 1978.

In carrying out these responsibilities, the Office formulates and manages programs to provide management and technical assistance and financial assistance to minority businesses and educational institutions to enable them to participate in the Department's research and development activities. The Office conducts a research program to determine the effects of national energy programs, policies, and regulations of the Department on minorities, and is developing and making recommendations to the Secretary on programs to assist minorities and minority business enterprises.

FY 1984 Funding Levels
(In thousands of dollars)

	FY 1984
Management and Technical Assistance for Businesses and Educational Institutions	452
Research	100
Financial Assistance	550
Program Direction	572
	1,674

The accomplishments of the past year have been highly successful as they relate to the legislative mandate; and as they positively impact the programs which the Office plans to accomplish during the remainder of FY 1983. For FY 1983, our two top priority programs emphasize (a) the development of energy policies which will be sensitive to minority concerns and (b) improvements in the level of management and technical assistance and financial assistance programs to minority businesses. The objective of these priority programs is to facilitate increased participation of minorities in fundamental energy programs and in the technology development programs of the Department. In this way, minorities will be able to become an integral part of the developing energy industry.

The Office of Minority Economic Impact continues to work toward the completion of all of the above-mentioned goals in the three program areas of research, management and technical assistance, and financial assistance.

Mr. Chairman, this concludes my remarks. I would be happy to answer any questions which you or the members of your Subcommittee might have concerning our program activities.

STATEMENT OF GEORGE BRADLEY, PRINCIPAL DEPUTY ASSISTANT SECRETARY FOR INTERNATIONAL AFFAIRS

Mr. Chairman, Members of the Subcommittee:

It is a pleasure to appear before this Subcommittee to discuss the FY 1984 budget request for the Office of International Affairs.

The Department of Energy's Office of International Affairs supports various entities of the US Government in international energy and nuclear nonproliferation programs. We do this by providing the necessary leadership in developing and carrying out international energy policy and programs throughout DOE; by tying together domestic and international energy policies and programs; by administering the Department's international nuclear program including U.S. policies on nuclear cooperation, non-proliferation and exports; by processing subsequent arrangements; and by developing, implementing and evaluating international cooperative research and development agreements.

We accomplish DOE's international objectives in a variety of ways. For example the Department works closely with other nations, under the aegis of the International Energy Agency, (IEA) on energy security and disruption issues. During 1982 we helped refine oil sharing systems which obligate member countries to maintain 90 days of emergency oil reserves, which would reduce oil demand by 10% in the event of disruption or shortfall and which would allocate supplies among participants during shortfalls. Additionally, US energy security is enhanced daily as we continue to fill the Strategic Petroleum Reserve. Since January of 1981 the amount of oil stored in the reserve has increased from 110 million barrels to over 300 million at the end of December 1982. During 1982 we successfully negotiated a major oil purchase contract with Mexico for the reserve.

The United States is firmly committed to the strengthening of the international nuclear nonproliferation regime and, in cooperation with the Department of State, we work closely with the International Atomic Energy Agency (IAEA) and the Nuclear Energy Agency of the OECD as well as with individual countries to improve safeguards and to achieve this vital objective. In addition, we will continue to fulfill our statutory responsibilities in reviewing export licenses and in the approval of "subsequent arrangements" for the transfer of special nuclear materials and equipment.

Another key area of DOE involvement in important international programs is in the negotiation and administration of over 100 cooperative energy research and development agreements with 22 nations and the IEA and NEA. During 1982 we entered into 15 new cooperative bilateral agreements and annexes. These include agreements with Canada in radioactive waste management, steam flooding of tar sands, and technical information transfer; with the European Community in radioactive waste management and safeguards of nuclear materials; with Switzerland in fast reactor fuel development; with Gabon in solar energy; with Venezuela in petroleum product utilization and coal preparation and combustion; with Japan in fast reactor physics and safety, solar energy and magnetic fusion; and with France and the Netherlands in technical information transfer. In the drafting and negotiation of these agreements we provide considerable specialized support and assistance to the Department's technical programs. We also continued to provide support in the coordination and administration of existing research and development agreements in fossil, renewable, nuclear and fusion energy, as well as energy end use or conservation.

At the end of calendar 1982 we were working toward development of a number of new cooperative activities. These include a major program, in cooperation with Japan, the European Community, and Canada, to investigate whether these nations are interested in providing the remaining funds needed to build the Fusion Materials Irradiation Test Facility at Richland, Washington; a program in conjunction with the Nuclear Regulatory Commission and involving eight to ten other countries for cooperation in light water reactor safety at the LOFT (Loss of Fluid Test Facility) in Idaho; expanded or newly-instituted nuclear cooperation with Japan, France, Egypt, China, the United Kingdom, and the Nuclear Energy Agency; basic scientific research with Japan and France; and renewable energy or energy conservation with France and the European Community.

Some of our other accomplishments during the past year included:

- Enhancing long-term US/Mexican energy relations by promoting a series of high level nuclear related information exchanges and the start of developing a program in petroleum R&D.
- Revitalizing the OECD Nuclear Energy Agency (NEA) to foster a more favorable international climate for nuclear energy and to promote US interest through international nuclear cooperation.
- Continuing efforts within the IEA to persuade member countries to move away from oil market intervention and regulation in the event of disruptions to reliance primarily on market forces.
- Strengthening energy ties with Saudia Arabia through extension for three years of a research, development, and demonstration program in solar energy.
- Focusing the IEA's Committee on Research and Development on the need to support international R&D coopera-

tion on long term, high risk projects, leaving other efforts to the private sector.

- Providing international energy market analytical capability to assist US government policymakers with an overview of critical oil market trends and their related political, economic and strategic implications.

The work of the Office of International Affairs is carried out by four primary organizations reporting to the Office of the Assistant Secretary. These are:

The Office of International Market & Policy Analysis which provides indepth analysis of trends in world energy supply and demand with particular emphasis on policy implications; maintains close liaison with the analytic community in universities, industry and policy research centers; identifies policy implications of theoretical and empirical developments in the outside analytic community for use in the process of policy formulations; evaluates substance and methodology of various analyses of energy supply and demand as required for policy formulation.

The Office of International Emergency Measures which manages and coordinates the international aspects of DOE/US participation in contingency planning programs and coordinates and implements policies regarding related US participation in the IEA, NATO and the European Community.

The Office of International Energy Cooperation is responsible for developing, analyzing, coordinating, and implementing policies and activities regarding US international energy. cooperation. This includes energy technology (nuclear and non-nuclear R&D) cooperation as well as bilateral energy relations and related international trade in areas such as oil and coal with energy producing and consuming nations, together with negotiation and administration of the Department's international energy research and development agreements.

The Office of International Non-Proliferation Policy which is responsible for developing and implementing US nuclear non-proliferation, cooperation (non-R&D), and export policies.

The Office of International Affairs' budget request for FY 1984 is shown in the following table.

FY 1984 Budget Request
(Budget Authority - in Millions of Dollars)

	FY 1983	FY 1984
International Policy Studies	.3	.3
Program Direction	3.1	2.3
	3.4	2.6

Authorizing legislation: Sec. 101, P.L. 96-367

Our FY 1984 budget request is below our FY 1983 budget, reflecting no change in funding for International Policy Studies and a $878,000 decrease for program direction. The specifics are as follows:

International Policy Studies

The Office of International Affairs has lead responsibility for keeping track of energy developments outside the United States, including both technological changes as well as their effect on economic systems. To assist us in doing this IA relies on international policy studies, which provides independent data and analyses on world energy issues and broader bases for policy formulacion. The FY 1984 budget request for this activity is $250,000, the same amount as in FY 1983.

During FY 1982, some 12 studies, assessments and models were funded by International Affairs. These included such subjects as monitoring world oil tanker movements, inter-government oil deals, the structure of the international gas industry, the improvement of international nuclear safeguards, as well as industry reports to support IA's continuing responsibility to keep abreast of international energy developments. During FY 1983 several of these activities will be continued, including further development of the model to track oil tankers and improvement of nuclear safeguards. Additional international policy related studies are planned, concerning energy supply, energy security, and energy technologies.

The funding level of $250,000 requested in FY 1984 will provide for an equivalent level of activity, with shifts in the actual areas of study dependent on changes in world conditions. The funds will be expended at various national laboratories, universities, other federal agencies, and private research firms.

Program Direction

The FY 1984 budget request of $2,326,000 for program direction is a decrease of $878,000 from FY 1983. This funding provides, at a reduced level, for the salaries and benefits of IA's civil service staff, composed of international energy economists, regional and technical specialists, and world oil market analysts. The staff's professional skills permit the Office of International Affairs to perform the Department's legislatively mandated role in the international energy field.

In FY 1983 IA has a staffing level of 54 FTEs. In FY 1984 we are requesting 35 FTEs.

We look forward to continuing to support the U.S. Government's international energy programs and to working for the improvement of the internatinal energy climate.

Mr. Chairman, this concludes my statement. I will be glad to answer any questions you may have.

BIOGRAPHICAL SKETCH OF GEORGE J. BRADLEY

George J. Bradley is the Principal Deputy Assistant Secretary for International Affairs, U.S. Department of Energy (DOE). In this capacity, he is responsible for international aspects of U.S. energy policy, including analytical assessments of nuclear nonproliferation and related activities.

Prior to his current appointment, Mr. Bradley served as the Deputy to the Principal Deputy Assistant Secretary for International Affairs. In this capacity, he provided policy advice to the Assistant Secretary and Principal Deputy, and acted on their behalf.

Before coming to Washington, Mr. Bradley served as U.S. Department of Energy Representative in Brussels. In this position, he counseled high-level European energy officials and advised the U.S. Ambassador to the European Community on matters concerning American and European research and regulatory policies and programs.

Mr. Bradley, who is a 20-year career manager, previously served as Executive Director for Defense Programs in DOE; as Associate Assistant Administrator for National Security in the Energy Research and Development Administration (ERDA), DOE's predecessor agency; and as Director for Policy Analysis and Field Operation, ERDA, specializing in policy, programing, budget, and organization.

Mr. Bradley's education includes a BA from Morningside College in Iowa, an MA (public administration) with honors from the University of South Dakota, and completion of basic requirements for his Ph. D. in International Relations at the University of Maryland. He is fluent in Italian.

. Mr. Bradley is married, has two children, and resides in Silver Spring, Md.

QUESTIONS SUBMITTED BY SENATOR HATFIELD

Departmental Administration

Question: Your FY 84 request proposes a substantial reduction from FY 83 in departmental administration -- is your request based on merger or reorganization of DOE? Do you have adequate funding requested in FY 84 to carry out your program, if merger is not implemented?

Answer: The FY 1984 Budget Request as submitted was based on the assumption that reorganization or merger would occur by October 1, 1983. If reorganization or merger does not occur, the level of required staffing and associated funding for FY 1984 will have to be reviewed.

Question: Your budget request "reflects savings in certain overhead functions as a result of the planned merger" of the Department.

-- First, will the Administration be working toward dismantlement or merger of the Energy Department?

-- If this does not occur, will there be a lack of funding to carryout general management and support activities? How much additional funding is needed?

-- For the record, please provide a detailed breakdown for each activity of the additional funding requirements.

Answer: We believe it is not necessary to have a cabinet - level agency devoted solely to energy. The details and timing of our proposal on energy reorganization, however, still are being worked out.

If the merger of energy activities is not approved or is not approved in its entirety, we will make every effort to accommodate our workload requirements within the funds and staffing in the fiscal year 1984 budget request, In specific areas, however, we may have to reevaluate our requirements depending upon the final action taken regarding reorganization and final action concerning the Department's request in program areas which this account supports.

Departmental Administration Revenues

Question: In your statement, there is $209 million anticipated in off-setting revenues for departmental administration. Can you describe in general the source of these revenues and why you expect more in FY 1984 than the FY 1983 estimate of $175 million.

Answer: The $209 million revenue estimate in FY 1984 represents the current estimate of revenues to be earned from products and services provided to users outside the Department and from the sale of marketable program by-products. The anticipated increase in revenues results from increased demand for products and services and from annual increases in prices the Department charges purchasers. The revenues come from a number of sources, including the sale of radioisotopes that are essential to medical research, special reactor developed materials, irradiation services, test reactor experiments and special test activities at the Nevada Test Site. In addition to these revenues, other miscellaneous revenues are earned as by-products of program activities, such as, the sales of steam that is an incidental by-product of nuclear materials production.

Plant Engineering and Design

Question: Explain the need for the $1 million for Plant Engineering and Design. Do you have a list of projects under consideration?

Answer: Typically, Conceptual Designs for DOE projects are completed 18-24 months before authorizing legislation is enacted, after which time Architect-Engineering (A-E) design work is normally initiated. This situation creates problems of outdated project scope, cost estimates, and schedules. Recognizing this, Congress made available Plant Engineering and Design (PE&D) funds in the FY 1979 budget. The PE&D activity identifies and supports, through the funding of advanced A-E services, continuity of effort on certain proposed projects considered critical to the timely accomplishment of the Department's mission. As a result of the application of PE&D funds, selected projects can proceed directly from Conceptual Design into Preliminary (Title I) and Definitive (Title II) design. The investment of these funds provides the specific benefits of (1) availability of more reliable cost estimates and schedules at the time of budget considerations; (2) uninterrupted design progression following Conceptual Design; (3) accelerated completion of energy R&D construction projects to meet program mission needs; and (4) cost savings due to accelerated design and physical construction.

We do have a tentative list. A call for FY 1984 candidate projects was sent to all Assistant Secretaries and the Director of Energy Research on January 24, 1983. At the time the PE&D funds become available, a final selection will be made to provide the funds at the earliest time in the fiscal year to be most beneficial to projects.

In-House Energy Management

Question: Please explain why the FY 84 request includes $14.4 million for in-house energy management. For the record, provide a list of all projects with FY 84 requirements, total estimated cost, and payback period.

Answer: The $14.4 million request continues the level of effort to approach the established energy savings required by Executive Order 12003 in the National Energy Conservation Policy Act of 1978 (Public Law 95-619). The continuation of energy conservation surveys at this level will allow for the identification of candidate projects for future years to continue the program of reducing energy costs in our weapons production and energy research and development facilities.

A list of all projects are as follows:

	($000)	Payback Years
Surveys and Central Plant Studies	1,200	--
High Temperature Distribution System, Los Alamos National Laboratory	1,700	3.30
Modifications for Energy Management Various Locations	11,500	2.29

Small modification projects at various locations are as shown in a list I would like to insert for the record.

FY 1984 MODIFICATIONS FOR ENERGY MANAGEMENT, VARIOUS LOCATIONS

PROJECT SITE	PROJECT TITLE	TOTAL COST $1000	PAYBACK PERIOD (YEARS)
**	**	******	*******
PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH, KY	SEAL BYPASS HOUSING, HOUSING AREA	670.0	.4
ROCKY FLATS PLANT, GOLDEN CO.	MIXING BAFFLES FOR SUPPLY AIR PLENUMS	52.0	.4
FEED MATERIALS PRODUCTION CENTER, FERNALD, OH	ADD MISNG OR REPL DMOD STM LINE INSULATN	47.0	.4
STANFORD LINEAR ACCELERATOR CTR, STANFORD, CA	ELECTRONIC HVAC TIMERS	9.5	.5
UNIVERSITY OF NOTRE DAME, SOUTH BEND, IN	SETBACK THERMOSTATS, FREQUENCY DRIVES	82.0	.8
RICHLAND OPERATIONS OFFICE, RICHLAND WABURGH PA	STATION SVC FROM EXCESS NUC STM, 100-N	780.0	1.7
ENERGY TECHNOLOGY ENGRNG CTR SANTA SUSANNA, CA	RETROFIT INTERIOR LIGHTING & A/C	28.0	.9
LAWRENCE LIVERMORE NATIONAL LAB, LIVERMORE CA	INSTALL DEADBAND AND TIMECLOCK BLDG 341	20.0	1.1
LAWRENCE LIVERMORE NATIONAL LAB, LIVERMORE, CA	INSTALL DEADBAND AND TIMECLOCK BLDG 227	16.0	1.2
NEVADA TEST SITE, MERCURY, NV	TIME CLOCKS & WEATHERSTRIP ATLAS AREA	29.0	1.1
PORTSMOUTH GASEOUS DIFFUSION PLANT, PORTSMOUTH, OH	X-750 & X-746 DOOR DRAFT CURTAINS	40.0	1.3
BROOKHAVEN NATIONAL LABORATORY, UPTON, NY	INSULATE MASONRY BLDG WALLS-VARIOUS BLDS	920.0	1.1
AMES LABORATORY, AMES IOWA	HVAL CONTROL MODS-METAL DEVELOPMENT BLDG	95.0	2.0
PRINCETON PLASM PHYSICS LABORATORY, PRINCETON NJ	POWER LINE CARRIER	40.0	1.2
LAWRENCE LIVERMORE NATIONAL LAB, LIVERMORE, CA	INSTALL HVAC CONTROLS MODS BLDG 225	99.0	1.3
LAWRENCE LIVERMORE NATIONAL LAB, LIVERMORE, CA	INSTALL HVAC CONTROL MODS BLDG 243	42.0	1.4
UNIVERSITY OF NOTRE DAME, SOUTH BEND, IN	SETBACK TSTATS, FREQ DRIVES & COIL LOOP	230.0	2.1
LAWRENCE BERKELEY LABORATORY, BERKELEY, CA	ENERGY MONITORING & CTL SYS INCREMENT II	600.0	2.5
Y-12 PLANT, OAK RIDGE TN	2-WAY CONTRL VALVES & MAKE-UP AIR LOUVRS	410.0	2.2
PANTEX PLANT, AMARILLO, TX	TWO SPEED MOTOR RETROFIT ZONE 12	115.0	1.7
PITTSBURGH ENERGY TECHNOLOGY CTR, PITTSBURGH PA	MOTOR CONTROLS BLDGS 83 & 71	125.0	1.7
BROOKHAVEN NATIONAL LABORATORY, UPTON, NY	IMPROVE EFFICIENCY OF MAG-AMP UNITS	940.0	1.5
ARGONNE NATIONAL LABORATORY, CHICAGO, IL	REDUCE SITE STEAM DISTRIBUTION PRESSURE	760.0	2.1
MASSACHUSETTS INSTITUTE OF TECHNOLOGY, BOSTON, MA	BUILDING ENVIRONMENT SYSTMS MODIFICATION	72.0	1.8
PRINCETON PLASM PHYSICS LABORATORY, PRINCETON NJ	CENTRAL CHILLER PLANT OPTIMIZATION CNTRL	75.0	1.6
ARGONNE NATIONAL LABORATORY, CHICAGO, IL	UPGRADE EXISTING FUME HOOD VAV CONTROLS	270.0	2.7
BROOKHAVEN NATIONAL LABORATORY, UPTON, NY	HVAC MODS TANDEM VAN DE GRAFF	135.0	1.9
PRINCETON PLASM PHYSICS LABORATORY, PRINCETON NJ	RETROFIT OF SMALLER ELECTRIC MOTORS	195.0	1.8
KANSAS CITY PLANT, KANSAS CITY, MO	MODIFY DEHUMIDIFYING SYSTEMS	415.0	2.4
PRINCETON PLASM PHYSICS LABORATORY, PRINCETON NJ	VARIABLE FREQUENCY MOTOR DRIVES	530.0	1.9
OAK RIDGE GASEOUS DIFFUSION PLANT, OAK RIDGE, TN	K-1414 ROOF INSULATION	24.0	2.7
SANDIA NATIONAL LABORATORY, ALBUQUERQUE, NM	POWER FACTOR CORRECTIONS	100.0	2.2
PRINCETON PLASM PHYSICS LABORATORY, PRINCETON NJ	EFFICIENT BOILER CHEMICAL FEED TANKS	19.0	2.4
PRINCETON PLASM PHYSICS LABORATORY, PRINCETON NJ	DAS COMPUTER ROOM FREE COOLING	29.0	2.2
LAWRENCE LIVERMORE NATIONAL LAB, LIVERMORE, CA	INSTALL DEADBAND CONTROL MODS BLDG 214	7.3	2.7

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LAWRENCE LIVERMORE NATIONAL LAB, LIVERMORE, CA       INSTALL DEMAND/DEADBAND/TIMECLOCK 343        28.0     2.8
RICHLAND OPERATIONS OFFICE, RICHLAND WA              OFF-SHIFT VENT SETBACK 324 BLDG, 300A       415.0     4.8
SAVANNAH RIVER PLANT, AIKEN CA                       MODS TO REFRIGERATION SYSTEM ADMIN AREA     225.0     3.6
SAVANNAH RIVER PLANT, AIKEN CA                       LIGHTING IMPROVEMENTS 321-M                 105.0     3.1
LAWRENCE LIVERMORE NATIONAL LAB, LIVERMORE, CA       INSTALL DEADBAND CONTROL MODS BLDG 223        6.0     3.1

MORGANTOWN ENERGY TECHNOLOGY CTR, MORGANTOWN, WV     INSTALL CEILING RECIRCULATING FANS           81.0     3.8
PRINCETON PLASM PHYSICS LABORATORY, PRINCETON NJ     TFTR D-SITE HIGH EFFICIENCY LIGHTING         37.2     2.1
Y-12 PLANT, OAK RIDGE TN                             LIGHTING MODIFICATIONS BLDGS 9202-2 & 4     265.0     3.4
ARGONNE NATIONAL LABORATORY, CHICAGO, IL             MOD HVAC CNTRLS REDUCE O.A. 600 AREA         33.0     3.4
FEED MATERIALS PRODUCTION CENTER, FERNALD, OH        REDUCE LIGHTING FIXTURES                    145.0     1.7

PRINCETON PLASM PHYSICS LABORATORY, PRINCETON NJ     DEADBAND THERMOSTATS & CEILING FANS          25.0     2.8
LAWRENCE LIVERMORE NATIONAL LAB, LIVERMORE, CA       INSTALL HVAC CONTROL MODS BLDG 224           15.0     3.2
STANFORD LINEAR ACCELERATOR CTR, STANFORD, CA        POWER FACTOR MOTOR CONTROLLERS               77.0     3.3
SAVANNAH RIVER PLANT, AIKEN CA                       LIGHTING IMPROVEMENTS 320-M                 105.0     3.7
SAVANNAH RIVER PLANT, AIKEN CA                       MODIFICATIONS TO POWERHOUSE FANS            600.0     4.1

INHALATION TOXICOLOGY RES INST, ALBUQUERQUE, NM      VARIABLE AIR VOLUME CONVERSION 3 BLDGS      100.0     3.3
IDAHO NATIONAL ENGINEERING LAB, IDAHO FALLS,ID       INEL LIGHTING & HVAC IMPROVEMENTS           310.0     2.4
STANFORD LINEAR ACCELERATOR CTR, STANFORD, CA        COMPUTER BUILDING ECONOMIZER                 12.0     3.5
FERMI NATIONAL ACCELERATOR LABORATORY, BATAVIA IL    TSTAT CONTROL VALVES FOR FINTUBE CNVCTRS    104.0     4.4
BROOKHAVEN NATIONAL LABORATORY, UPTON, NY            DESTRATIFY HIGH BAY AREAS, 8 BUILDINGS      105.0     3.7

STANFORD LINEAR ACCELERATOR CTR, STANFORD, CA        NEW COOLERS CENTRAL UTILITY COMPRESSOR       12.0     3.8
KANSAS CITY PLANT, KANSAS CITY, MO                   MODIFICATION OF EXHAUST SYSTEMS             300.0     3.8
Y-12 PLANT, OAK RIDGE TN                             LIGHTING MODIFICATIONS BUILDING 9201-5      305.0     4.3
SANDIA NATIONAL LABORATORY, ALBUQUERQUE, NM          EVAP ASSIST BLDG 887 OFFICE AREA             15.0     3.7
BROOKHAVEN NATIONAL LABORATORY, UPTON, NY            BUILDING ENVELOPE MODS, BLDGS 129 & 624      56.0     3.5


SUMMARY OF ENERGY MANAGEMENT PROJECT LIST:

NUMBER OF PROJECTS =  60
TOTAL TEC ($K)= $11502.0
AVERAGE SAVINGS TO INVESTMENT RATIO=  9.06
AVERAGE DISCOUNTED PAYBACK PERIOD (YEARS)=  2.29
ANNUAL ENERGY SAVINGS (BILLION BTU)=  1480.5
ANNUAL DOLLAR SAVINGS ($K)= $5381.9
AVERAGE ENERGY SAVINGS PER DOLLAR INVESTED (MBTU/$)=  .129


SUBGROUP =
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Funding for Council of Energy Resource Tribes

Question: The Congress provided $600,000 in FY 83 from DOE for Council of Resource Tribes (CERT) program. How much is proposed in the FY 84 budget for CERT? Why? Is their work complete?

Answer: The FY 1984 Congressional budget request does not include funds for the CERT program. DOE feels that CERT should become self-supporting and, hence, advocates an orderly phaseout of Federal funding.

Congressional, Intergovernmental and Public Affairs

Question: Please explain your efforts over the last three years to reduce the Congressional, Intergovernmental and Public Affairs budget and staff, and provide a breakdown.

Answer: Over the past three years, Congressional, Intergovernmental and Public Affairs has coordinated Departmental relations with the Congress, the news media, other governmental entities, the private sector and consumers as well as promoting competition in the energy industry while reducing dollar and staffing levels by 46 and 37 percent, respectively. Further reductions are anticipated for FY 1984 if DOE is merged with another Department. A breakdown of the reductions follows:

	FY 1980	FY 1981	FY 1982
Budget Authority (in millions)			
Program Support	$ 4.3	$ 4.4	$ 0.4
Program Direction	9.1	8.5	6.8
Total BA	$13.4	$12.9	$ 7.2
Full-time Permanent Ceiling	222	141	137

Question: Provide the Committee with the anticipated Congressional Affairs workload in FY 84.

Answer: In FY 84, we will continue efforts to establish and maintain effective and harmonious relations between the Department and the Congress and its Committees. These efforts require coordination of energy issues with the 29 Senate and House full Committees and 53 Subcommittees which share some jurisdiction over the Department.

Also, we will coordinate activities related to the consideration and passage of new and revised energy legislation such as changes to natural gas law; nuclear licensing reform; merger of the Department with the Department of Commerce; continued funding of the Clinch River Breeder Reactor (CRBR); obtaining Congressional approval of the FY 84 reduced energy budget, particularly in the areas of Conservation and Fossil; Solar Energy National Security and Emergency Act (SENSE), coal slurry pipeline; electric utility industry reform; and energy emergency legislation that emanated from the statutorily required report on energy emergency response procedures.

Finally, we will respond to Congressional requests for information and for appearances before Congressional Committees in hearings, with a view to furthering the Administration's policy in Congress. In FY 1983, this activity included responding to approximately 100,000 telephone calls, and monitoring approximately 2,000 Congressional hearings, markups, briefings, floor actions, and conferences. During the 97th Congress, this activity included the preparation of 729 Departmental witnesses for 335 hearings.

Question: Explain the reason for elimination of the consumer affairs activities.

Answer: The FY 1984 budget request includes continuation of the Office of Consumer Affairs within the Office of the Assistant Secretary for Congressional, Intergovernmental and Public Affairs, but at a reduced level. No funds are requested for contractor support, which will be provided by program areas as appropriate.

Energy Competition Analysis

Question: Explain the contractual analysis of energy competition issues and the reason for its elimination.

Answer: In the past much of the money for contractual analysis was required for Congressionally mandated studies. For example, the Office of Competition was required to produce a study pursuant to the Petroleum Marketing Practices Act, P.L. 95-297, which required substantial funding. In addition, the Office of Competition was the lead Office with respect to another Congressionally mandated report to study competition in the coal industry required by the Powerplant and Industrial Fuel Use Act, P.L. 95-620. With the completion of these studies or repeal of the requirement for these studies, the need for contract funds for the Office diminished. Also, as the character of the studies undertaken by the Office changed from long-term studies to short-term studies, the need for contractual support diminished. In FY 1982 and 1983, the Office has had contractual support funding available; however, very little has been expended as the Office has relied principally on in-house efforts. In FY 1984, under the proposed merger, the competition function would be assumed and funded by other energy program officials.

Oil Pricing Enforcement Program

Question: On page 1 of your statement, you mention that there are 357 pending cases pertaining to the oil pricing enforcement program. Please elaborate on the status of this effort.

Answer: The Administrator of the Economic Regulatory Administration is continuing this effort to settle all open enforcement matters. Where settlement is not possible, the cases are being prepared for litigation. As that effort proceeds, it may generate a considerable number of additional litigation cases; how many will depend upon the number of cases in which settlement efforts are unsuccessful.

The Office of General Counsel, in conjunction with the Department of Justice, is responsible for all judicial litigation in connection with the enforcement program and for all administrative litigation other than that against the 35 largest refiners. Within the past year, a number of important decisions were issued in some of our major judicial litigation cases. These include United States v. Exxon, CA. No. 78-1035 (D.D.C. March 25, 1983), a direct judicial enforcement case in which the District Court recently found Exxon liable for about $900 million in overcharges, plus interest; the Stripper Well Litigation (In re Department of Energy Stripper Well Litigation, 690 F.2d, (TECA 1982), cert. denied subnom. Energy Reserves Group v. Hodel, ______U.S.______, 103 S.Ct. 763 (1983)) in which the legal basis for recovering more than a billion dollars in overcharges has been established, although there are probably several years of vigorous litigation still to come concerning the appropriate remedy; and Louisiana v. DOE, 690 F.2d 180 (TECA 1982), cert. denied ____U.S.____, 51 U.S.L.W. 3720 (April 5, 1983), in which the most important part of the necessary legal basis to recover up to one billion dollars from Texaco has been established, although again much work lies ahead.

Litigation is a slow process, and the litigation in the enforcement cases has been no exception. For example, the three cases just discussed were commenced in 1978, 1977 and 1980, respectively, and none is yet completed. At present, the resources of the Office of General Counsel and our budget request for FY 1984 are adequate (but not overgenerous) for pursuing our caseload, provided that the estimates of number of enforcement matters likely to be settled proves not to be too optimistic.

Radiation Injury Claims

Question: What is the extent of radiation injury claims against the government. Provide a status report, particularly on the cases in Utah which have received recent publicity.

Answer: The United States and several DOE contractors are currently involved in extensive litigation dealing with claims by persons that radiation has caused personal injuries and deaths, primarily from cancers. Diminution of property values is also claimed. The litigation arises out of governmental activity involving atomic weapons testing, both on the continent and in the Pacific, as well as claims by uranium miners and persons living near mill tailings and formerly utilized sites. Plaintiffs in those cases include servicemen and veterans who participated in nuclear tests; government and contractor employees who worked at the test sites and in the various laboratories and contractor facilities; and persons living within the vicinities of the continental and Pacific test sites. There are over fifty cases with more than 5,000 plaintiffs. Claims run in excess of $10 billion.

Only a few of the cases have gone to trial. Some have been dismissed on jurisdictional motions pleading governmental immunity or statute of limitations. Many others are in various stages of discovery. Two cases were tried in Utah last year. Allen et al. v. United States involves 1192 plaintiffs who lived downwind of the Nevada Test Site in southern Utah, southern Nevada, and northern Arizona. They claim that cancers and leukemias were caused by radioactive fallout from the atmospheric tests from 1950-1962. Judge Jenkins has the case under advisement after a three month trial. Bulloch et al. v. United States, a case in which shepherds alleged injuries and deaths to their sheep as a result of fallout from two tests in 1952, was reopened upon a finding by Judge Christenson of fraud on the court in the 1955 trial. The case is presently on appeal in the U.S. Court of Appeals for the Tenth Circuit.

Question: Indicate specifically the status and your efforts in the cases alleging damages as a result of atomic testing in U.S. territories in the Pacific.

Answer: The Pacific testing cases fall broadly into two categories: those brought by Marshall Islanders alleging personal injury, taking of property and other claims; and those brought by veterans claiming personal injuries as a result of their participation in the tests. Defendants include both the United States and its contractors. The cases are in various stages of motions and discovery with both government and private counsel participating. A major effort to resolve much of that litigation out of court continues in the negotiations for free association being conducted with the Marshall Islands Government. The proposed compact includes a compensation provision which would provide an exclusive remedy to the islanders for all claims.

Office of Minority Economic Impact

Question: Is the FY 84 budget request based on reorganization or merger of the Department?

Answer: The FY 84 budget request was based upon reorganization or merger of the Department.

Question: What activities, if any, are being reduced or completed in the FY 84 proposal which were funded in FY 83?

Answer: Due to reduced funding levels from $1.916 million in FY 83 to $1.674, the Office will have to once more scale down its program activities in:

a. Minority Business Enterprise
b. The Minority Honors Vocational Training Program in Energy-Related Technologies
c. Financial Assistance in the Minority Business Loans
d. Losing one other-than-full-time staff person

Emergency Preparedness

Question: Please outline briefly the Department's program for emergency preparedness and contingency planning.

Answer: DOE's program for responding to petroleum supply interruptions and other types of energy emergencies contemplates primary reliance on the free market, supplemented as necessary and appropriate with the following broad types of measures: SPR drawdown; international cooperation; surge production; measures to facilitate market adjustments (such as public information, liaison with State and local governments, industry advisory committees and other forms of industry participation); use of the Defense Production Act and other extraordinary authorities to meet defense petroleum needs. Monetary and fiscal policy actions currently are being examined.

Question: Does DOE have any contingency plan in case of another major oil disruption?

Answer: The Department of Energy, and the Federal Government as a whole, is prepared to respond appropriately to a major oil supply disruption, should that occur. The overall approach, as well as the specific programs, were described in the report submitted to Congress by the President on December 31, 1982, entitled "Comprehensive Energy Emergency Response Procedures." As discussed in response to the question above, the Administration's strategy for responding to petroleum supply interruptions and other types of energy emergencies contemplates primary reliance on the response of the marketplace to adapt and respond to the situation. The free market approach will be supplemented as necessary and appropriate with a range of possible measures, such as SPR drawdown; mechanisms under the International Energy Agency; surge production; measures to facilitate market adjustments (such as public information, liaison with State and local Governments, industry advisory committees and other forms of industry participation); and in severe emergencies, use of the Defense Production Act and other extraordinary authorities to meet defense petroleum needs. The legal authorities available to be utilized in an energy emergency were described in the "Memorandum of Law: Legal Authorities Available to the President to Respond to a Severe Energy Supply Interruption or Other Substantial Reduction in Available Petroleum Products," submitted to the Congress by the Attorney General on November 15, 1982. Other mitigation measures, such as monetary and fiscal policy actions have been proposed by some and they currently are being examined.

Question: In your view, should DOE play a role in addressing energy emergencies and are your plans adequate?

Answer: Yes. There is a need for a central point of coordination for energy emergency preparedness activities in the Federal Government. DOE's role is to provide that ongoing capability for the coordination of effective energy emergency programs. As noted above, the principal strategy for responding to energy emergencies is reliance on the free market, coupled with the use of the SPR and other energy emergency response measures. These measures were described in detail in the "Report to Congress: Comprehensive Energy Emergency Response Procedures," December 31, 1982. The energy emergency preparedness capability of the Federal Government is fully adequate to respond appropriately to any energy emergency situation which might occur.

Senator COCHRAN. Senator Johnston?

Senator JOHNSTON. Thank you, Mr. Chairman.

Mr. Secretary, I want to congratulate you for the great work you have been doing on natural gas. I know you have been busy on that. I think it's a very innovative proposal which I hope can be fleshed out in all its details and be passed in this Congress.

Having given you the congratulations, I say that by way of saying that I don't think you are responsible yet for all the details of everything that goes on in your Department and particularly what has gone on in nuclear waste. But I must tell you I am more than a little bit exasperated at the 1984 budget regarding nuclear waste activities. I regard it as being somewhere between incompetent and a conscious effort to subvert the law. If that sounds too strong, let me tell you that for some 10 years in the Energy Committee we worked on the concept of monitored retrievable storage. We came to the conclusion years ago that geologic storage is going to be uncommonly difficult ever to get it actually stuck into the ground because when you go to write your environmental impact statement, the condition which you must satisfy is that that waste is going to be safe virtually for infinity, and it is a question that almost defies a geological answer in the degree of servitude which the law requires.

I hope they can find one, outside of salt domes, but I hope you can find one that is acceptable. I frankly don't think you can, because, you see, this is deja vu. They have been talking this way—"The solution is just around the corner"—for over 10 years. That is why we have come to the same conclusion that the British have come to, that the Germans have come to, that the Swedes, the Finns, and others have come to, that there is a better answer than geologic storage. And that is—call it interim, if you will—but basically it involves putting the waste away for a period of perhaps 10 years where you have convection cooling of those wastes for perhaps, as I say, 50 years, and then the problem is a different problem to solve. Then rather than putting away waste so hot that it melts the salt—and molten salt moves and flows—or cracks the granite or the basalt, or creates unknown geologic stresses in the medium, by being able to put it away for 50 years and then store the waste, then, as I say, the only problem you have at that time, basically, is the toxicity and radioactivity which are relatively minor characteristics compared to the management of this heat. I hate to go into all this detail, but we fought this battle so many times before. In the Congress before last, the Senate passed a bill which provided mainly monitored retrievable storage with permanent geologic storage simply as something to study.

In this past Congress, we came to a great compromise involving the Environment and Public Works Committee, and we went on what we call a parallel track, and that is replete throughout the legislative history—equal dignity so that both tracks would go forward. The idea was that you proceed with the geologic schedule with these various dates, and I hope you make them—I don't think you will.

It won't be your fault, but you are just going to find that the geologists are not going to all come in and say: "Yes, you can safely put it here, or there." They are just not going to agree. They haven't for the last 20 years, and we don't think they will agree in the next 20 years. And then, the other parallel track is the monitored retrievable storage. The act requires a plan sufficient to go to bids by—what is the date—June 1985—is that the date? Yes. Actually, we slid that date back a little bit from our earlier plan to make sure you have plenty of time, but recognizing it is still going to be a tough fight.

MONITORED RETRIEVABLE STORAGE

Now I look in this budget and I find that you have taken all the money out of monitored retrievable storage—zip, zero. Our parallel track means you spend over a billion dollars for geologic storage and you have $3.5 million for monitored retrievable storage and that is what you are left with in your 1983 appropriations.

You don't have any money in fiscal year 1984, none in 1985, according to this justification document. That is why I say it is either incompetence or a conscious effort to subvert the law, because no one could come to the conclusion that you could design, sufficiently to go to bid, a brand new technology and have it ready by 1985, and if anybody thinks that in your shop—well, I am anxious to talk to Shelby Brewer. Did he come up with this ridiculous conclusion?

Secretary HODEL. Let me respond to that question. First of all, we are aware of it, as you are, partly because at a prior hearing you made the point you are concerned we have funds in the budget for monitored retrievable storage. I can assure you I went from the hearing forthwith to find out why we didn't. What I learned was that we put the budget together prior to passage of the act; and that we are in the process now of identifying what we need in 1984 in order to carry forward with what the act requires.

I am sure I asked the questions in these terms, not in dollar terms, but in performance terms: Are we going to be able to meet that date? And I was assured the work is going on in 1983, and the work will go on in 1984, and whatever adjustments to the budget we have to make to do that, we will be able to do. So I think where we are lacking at the moment is in communicating with the committee the work that is going forward and not being able yet to identify what the 1984 request has got to be.

Senator JOHNSTON. Mr. Secretary, these budgets can be rewritten. It has been at least 2 or 3 weeks since you have been before the Energy Committee and this justification does not even describe what the law says: "A report to the Congress must be submitted—and sufficient—to go to congressional authorization."

It is more than a report. The last thing said, "sufficient to go to authorization," sufficient to take bids by January 1—excuse me, by June 1985. Now to take bids—that is, site-specific—at least the different alternatives, and you have to be able to go out in the field. It takes a long time to design one of these things. Whoever is doing this, if they can't even put together a paragraph in a budget document and have it accurately describe what the law specifically requires, given the years of work and legislative history on this, and given the attention in the Energy Committee with the Secretary of Energy and the people who run the committee, Lord knows they are not going to get it done this century.

I can't tell you how strongly I feel about this. I think it represents—well, I have already described what I think it represents, and I think it is inexcusable. I hope you will go back and tell them: "Look, we need some action now; you need to hire the right contractors." I understand you have brought aboard Bob Morgan, from Savannah River, to run the program. Maybe it's his fault. I don't know. Maybe he doesn't understand what we have in mind. That is the problem in this nuclear waste; that is, you have to reinvent the wheel. Somebody new comes in and says, "Monitored retrievable storage, what's that? Let's make a study and find out what it is." Time's a-wasting. It is too late for that. We need to get somebody in there who can do what the law requires because the Senate, as I say, in the Congress before last passed monitored retrievable storage as the primary track and then last year, as a concession, we went to dual tracking. And now the Department of Energy wants to go one track. Over a billion for geologic and $3.5 million—and that was last year's money, which I guess they will want to send back this year—for MRS.

STRATEGIC PETROLEUM RESERVE

Now, while we are on the subject of the law, you know what the law requires with respect to the Strategic Petroleum Reserve, and you had promised us a memo—I know your heart is in the right place—on why the Department of Energy is filling 116,000.

Secretary HODEL. 216,000.

Senator JOHNSTON [continuing]. 216,000 barrels a day when the law requires a minimum of 220,000, and then it requires you to fill at the rate of whatever money you have over the 220,000 barrels a day.

Secretary HODEL. Senator, I supplied the committee with a copy of my memorandum immediately following that hearing in which I directed that we move to the 220,000 barrel a day rate. That has been accomplished and we concurred in your legal view with what we are required to do.

Senator JOHNSTON. I think the only way we can get a memo out of OMB is to request it from you.

Secretary HODEL. I believe you have. I believe that has been provided to the Energy and Natural Resources Committee.

Senator JOHNSTON. That is on the 216,000 to 220,000?

Secretary HODEL. 216,000 to 220,000.

Senator JOHNSTON. How about the above 220,000?

Secretary HODEL. The last time I pursued that matter, the lawyers were still in disagreement, but I believe we are very close to a resolution. I don't know what to say with respect to how soon I can expect the lawyers to give me an answer.

Senator JOHNSTON. Probably about the end of the fiscal year.

Secretary HODEL. Sooner than that because, obviously, we have to make decisions by June. We will have to begin to anticipate what we will be doing.

HIGH-TEMPERATURE GAS-COOLED REACTOR

Senator JOHNSTON. Why are there no funds in this budget for the HTGR, the high-temperature gas-cooled reactor? Are you familiar with that particular program?

Secretary HODEL. Somewhat, yes.

Senator JOHNSTON. I personally think that while nuclear power in general is on the wane right now, that by the time we go through two phases, phase I is we don't build anything, and we have been in that phase now for some time, no new plant orders for the last 4 or 5 years. I don't know how many canceled either. But I think we are going to be in that phase for a few years, maybe 3 or 4 years, and then we will start having problems. Then we will look at the problem of coal and I support burning of coal, but you are going to have great problems, like this morning the Canadians are upset with us for acid rain and the Northeast is going to be upset and a lot of other people are going to be upset, air quality and soot on the clothesline and all that.

Sooner or later we are going to need to build some new reactors. I think the HTGR is a real live possibility. In addition to other advantages, it has an advantage of processed heat which goes so well with industry.

I think we ought to have some money to keep this program alive so that we have the ability to expand and go to that when the time comes.

I wish you would take a look at that and maybe advise us as to what you think it would take, or give us your opinion on it.

Secretary HODEL. I have looked at that because I had similar feelings about the HTGR having been exposed to the idea many years ago in the utility industry. In looking at the array of opportunities or requirements for spending money, it appeared to us that the high-temperature gas reactor has been essentially researched and designed to a point where it is commercially available as a technology. It is not necessary, in our view, for the Federal Government to continue a presence in that activity. I can recognize that we could continue to spend money, but we do not feel it would significantly move the technology forward as compared with the problems and the needs of research with the existing technology used in this society, the light water reactors. Therefore, in putting together a tight budget, we felt it was appropriate to withdraw from the HTGR. That is what we have done.

Senator JOHNSTON. It is in very much a developing stage. I understand the Fort St. Vrain reactor is now capable of going up to 100-percent power. I think they are spending about $8 million a year on that reactor to upgrade it constantly since it is one of a kind.

I am the last one to spend money where it is not needed, but I think this may be—one day we may wake up and say: "Oh, why didn't that occur to us before, that we can have a reactor with these advantages.

For example, that doesn't have melt-down potential." I am not saying PWR's are that dangerous, but they are perceived to be that dangerous, and in this business, perception is truth.

I think, perhaps, we ought to take a look at that HTGR program.

FUSION ENERGY PROGRAM

Now let me ask you, finally, on fusion, when are we going to be able to go to one principal fusion mode? Of course, the inertial confinement fusion is mixed up in the weapons programs, so I guess they make their own justification. I never have quite figured out exactly what they are doing in the weapons program. They say it's important and everybody sort of knowingly gives you that look. They never have explained it to me as to why it is that important, satisfactorily anyway, but I will take their word for it, at least for the time being. But on magnetic fusion, shouldn't we soon—let me ask you, when will we go to one mode, one that you will pick over the others?

Secretary HODEL. I have the view that fusion is where nuclear fission was 25 years ago. At that time we had a choice between light water reactors, boiling water reactors, high-temperature reactors, and breeder reactors. The decision was we ought to go forward and finally make a decision and live with it, because you say, while there are differences between technology, the differences are not vast. The decision was made. We only had so much money and so many resources to put forward.

It seems to me we are still at the stage in fusion where we don't know which of the approaches will be the most productive. Until we achieve at least a breakeven point and prove we are able to confine plasmas at temperatures that are required, it seems to me we probably should not make a selection of the final fusion design. We could make a decision and we might be right, but we should retain the option, it seems to me, as long as we can within that program to identify a fusion system which is best in economic and environmental terms.

Senator JOHNSTON. You hope to be at break-even on TFTR in 1984?

Secretary HODEL. I think actually the schedule to achieve this is fiscal year 1986 but we hope to initiate operation this spring, as you know.

Senator JOHNSTON. I would suggest to you that we are really not as far along as we were 25 years ago in light water reactors. Now we have them widely commercialized. I would suggest in 25 years from now, we won't have our first commercial unit on line. In fact, we may not have even our first large test reactor on line. Even then it may be as a breeder. And I have some doubt whether fusion will ever be a maker of commercial energy. I am not saying we ought to kill the program. I am saying that we ought to ask tough questions as this program progresses, because from what they tell me, it is going to be like 2040 before we have anything much in terms of fusion power, if, as I say, if ever, may be then as a breeder.

I think it is useful to ask those questions.

Secretary HODEL. Yes.

Senator JOHNSTON. Because we may justify it on pure science alone. I very much approve of your initiative to push forward with the atomic particle research and high-energy physics. I don't know what that is ever going to prove, but we didn't know what atomic science was going to prove either when we started on it—the neutrons, protons, and electrons. Now, we have quarks, leptons, and all that. We don't know what we are going to do with those either or what the program will lead to, but I guess they will continue to find something to use it for.

But I think we ought to be asking those tough questions as fusion proceeds. That is why, When are we going to make the choice between the various technologies?

Secretary HODEL. I will try to get a better sense of that. Also in regard to fusion, I think it is important to recognize we increasingly are working in a cooperative fashion internationally, because as we ask that tough question, and we must, so, too, are other nations asking that same question. We all sense it is a project that should not be allowed to wither and die, and yet we all look at the tremendous cost involved in carrying it forward.

As you say, it is a very long-term project. The question is whether a free democratic society has a will to commit to that kind of a technology over the long period of time. We are working earnestly to find ways to cooperate with foreign nations and certainly not duplicate or repeat in terms of the same technology.

Senator JOHNSTON. If I may just ask one more question. I had something on my mind. It slipped my mind. Maybe I will think of it later.

Thank you, Mr. Chairman.

GREAT PLAINS COAL GASIFICATION PROJECT

EFFECT OF GAS PRICING PROPOSAL ON SYNFUELS PROJECTS

Senator COCHRAN. Senator Burdick?

Senator BURDICK. Thank you, Mr. Chairman. I don't know whether this area has been touched upon or not. I will ask you one or two questions anyway.

It is my understanding the administration's gas pricing proposal requires that no pipeline may take gas from its own affiliate at a higher rate than its rate of less expensive gas; is that a correct statement?

Secretary HODEL. That is one of the 18 points in the proposal we have been discussing, yes.

Senator BURDICK. Using the Great Plains coal gasification project as an example—it is in North Dakota, as you know—if one affiliate cuts its rate of take from another source less expensive, then the affiliate will have to cut its rate of take from the Great Plains.

As you can see, Mr. Secretary, this proposal could have a devastating effect on synthetic fuels projects such as Great Plains.

Do you have any comment?

Secretary HODEL. Yes. In discussing this matter with one of the sponsors of the Great Plains project, recognizing it applied across the board and would have that effect, we recognized that is one of many specific examples where moving forward with legislation as complex as this gas bill will be, we have to be prepared to recommend and make adjustments.

This is just one of those. Clearly we do not intend by this process to foreclose activities in synthetic gas. How we deal with that at this moment, I don't have an answer, but I know we are going to have to or we would do precisely as you say, and put that plant in a very difficult position.

Senator BURDICK. I am glad to know you are aware of the problem and we are aware of the problem so we will be in touch, will we?

Secretary HODEL. We will be, yes, sir.

Senator BURDICK. You have nothing else to add?

Secretary HODEL. Not that I can think of.

TRANSFER OF ENERGY TECHNOLOGY CENTERS

Senator BURDICK. On another subject, last year, Mr. Secretary, the Appropriations Committee included language which allowed the transfer of the Grand Forks Energy Technology Center from the Federal Government to the State University of North Dakota.

Can you tell me, Mr. Secretary, how this transfer is proceeding, if you know?

Secretary HODEL. Yes, Senator. The cooperative agreement for the transfer will become effective on April 1. The agreement for the Laramie center is expected to be signed in the month of March.

Senator BURDICK. After transfers are made, what will be the Federal Government's participation?

Secretary HODEL. My understanding is we will continue to fund research activities there. The centers will plan and implement fossil energy research projects and technology base activities associated with their respective lead mission assignments.

Senator BURDICK. That is very good news.

Thank you, Mr. Chairman.

SPR CRUDE OIL PURCHASE REQUIREMENTS

Senator COCHRAN. Thank you, Senator Burdick.

Mr. Secretary, Senator Johnston asked you a question about the Strategic Petroleum Reserve. In view of the fact that we are seeing a downward trend of prices on the world market of crude oil, what is the Department doing to take advantage of the lower prices so we can save the Government some money?

Did I understand in your answer you are compelled by law to proceed to buy at what may be inflated prices and if you waited a little longer, you could purchase the oil cheaper?

Secretary HODEL. My understanding of the law is that, if funds are available, we are required to fill at a rate of not less than 220,000 barrels a day annually. Senator Johnston alluded to the fact we have a further legal question unresolved; if we had funds available beyond what is needed to fill at 220,000 barrels a day, will we have to use those?

We do not have a great deal of flexibility, as I understand it, under the law with regard to the level of purchases. This is partly because we have not reached real accord with the Congress over the exact way in which we ought to proceed.

We are still committed to a 750 million barrel Strategic Petroleum Reserve. We have suggested that we think there are ways to get there that are better than some of those precise methods contained in the language of the act but, obviously, we will comply with the act.

Senator COCHRAN. Is it the intention of the administration to send to the Congress proposals for amending that act?

Secretary HODEL. I have no present plans to do so, Mr. Chairman.

Senator COCHRAN. There is no present intention to do so.

Secretary HODEL. No present intention to do so because, as of the present time, we have not felt that there was a real likelihood that doing so would be received well by the Congress and I don't desire to act in a way which will exacerbate our relations.

Senator COCHRAN. I am sure there is a good reason for the majority of the Congress having that view. I frankly think we ought to give the Department a little more flexibility so we can take advantage of market opportunities. We are buying 750 million barrels, is that what you said?

Secretary HODEL. Our ultimate goal for the Strategic Petroleum Reserve is 750 million barrels.

Senator COCHRAN. How much do we have in there now?

Secretary HODEL. We have slightly more than 300 million barrels. We are continuing to fill at 220,000 barrels a day. At the end of 1984, the reserve will exceed 400 million barrels of oil if we went on the reduced fill rate we have recommended. This is 27 million barrels less than what we would have if we continued to fill at 220,000 barrels a day.

PROJECTED COST OF CRUDE OIL

Senator COCHRAN. What is the Department's projection, if you have one, on cost of crude oil in the world market a year from now?

What is it today, $30 or thereabout?

Secretary HODEL. It depends on what we are talking about. My understanding is on the spot market the price hit $27 in some instances today. We know the four Persian Gulf states are meeting today and the rumors, of course, fly from those meetings.

I received a briefing shortly before coming up here. Every indication is that the price of imported oil will drop significantly at least to the mid-1920's. I think at this stage I can provide you with estimates from the Department of Energy on the price of oil, but if they have not taken into account today's events, they are not really a realistic estimate.

It would be my guesstimate, based on what is happening and based on the oversupply capability of the world, that without some supply interruption, we would see oil prices in the mid-1920's for at least through the next year.

Senator COCHRAN. In spite of that, then, Congress is requiring the administration to buy oil for the Strategic Petroleum Reserve at $30 levels for the next several months, anyway; is that correct?

Secretary HODEL. And we have some long-term contracts for supply which would carry us through this fiscal year as well. We have a significant amount of oil which we have contracted for from Mexico as part of an advanced purchase arrangement.

Senator COCHRAN. Is most of the oil purchased from foreign sources, Iran or places like that?

Secretary HODEL. I believe almost all the oil going into the Strategic Petroleum Reserve is imported. But a large percentage of the Strategic Petroleum oil comes from Mexico. At the present time, about 160,000 barrels a day are coming from Mexico.

CLINCH RIVER BREEDER REACTOR

Senator JOHNSTON. Mr. Secretary, I understand that you have ongoing conversations with some of the nuclear industry and the utilities with respect to Clinch River and their participation.

Secretary HODEL. Yes.

Senator JOHNSTON. How does that look?

Secretary HODEL. From what I hear, I am encouraged that they will come forward with a proposal for significant funding of a portion of that project by the utilities and by the manufacturers so we can come back to Congress with a concept which is responsive to directives Congress gave us.

Senator JOHNSTON. And you are encouraged about that?

Secretary HODEL. I am encouraged, yes. I believe that the utilities industry clearly understands that we are not just going through the motions. We are not simply saying, "Try, but if you don't make it, we will push ahead anyway."

I have made it fairly plain I have no stomach for coming forward with the same level of request that we have had to come forward with in the past.

Senator JOHNSTON. Will that affect the 1984 budget request? Are you trying to do it in time for this cycle?

Secretary HODEL. It would affect not only the 1984 budget cycle but, depending on what was proposed, it could affect the 1983 figure as well.

I see a couple of options at the extreme. One is that we cannot come up with an option. Of course, then, we come forward and say we don't have a proposal.

The money we have in 1983 could be funneled down toward closing the project. On the other hand, if we have a proposal which calls for a means of funding that is on a different basis than in the past, presumably that also will have some effect on what we spend in 1983 and how we spend it and the rate at which we spend it.

Senator JOHNSTON. So you are really trying to put this together just imminently?

Secretary HODEL. March 15 is the date by which I am supposed to be back to the committee, or to the Congress. I cannot promise that I will be here but I am sure going to try to be here by that date with a proposal.

I believe we should be receiving late this week the committee's recommendation.

Senator JOHNSTON. Committee?

Secretary HODEL. The Utilities and Manufacturers Committee.

Senator JOHNSTON. Good luck.

Thank you, Mr. Chairman.

Thank you, Mr. Secretary.

ADDITIONAL QUESTIONS FOR THE RECORD

Senator COCHRAN. Mr. Secretary, those are all the questions that the subcommittee has today. We appreciate very much your being here to give us this overview of the Department's budget and look forward to working closely with you this year during the appropriation process.

Secretary HODEL. Thank you, Mr. Chairman.

Senator COCHRAN. Senator Abdnor has some questions for your response. Without objection, they will be made part of the record at this point.

[The questions and answers follow:]

QUESTIONS SUBMITTED BY SENATOR ABDNOR

Uranium Mill Tailing Remedial Action Program

Question: Mr. Secretary, would you, at the earliest possible opportunity, please provide the Subcommittee with a detailed report on the status of DOE activity at Edgemont, together with your best estimate of when we might expect to see DOE begin to remove tailings from off-site locations?

Answer: In response to the enactment on January 5, 1983, of Public Law 97-415, which authorized the Department of Energy to perform remedial action at contaminated properties in the vicinity of the Tennessee Valley Authority-owned uranium mill site near Edgemont, South Dakota, the Department has accorded this activity priority equivalent to that of the highest priority sites in the Uranium Mill Tailings Remedial Action Program, known as UMTRA, and will make every effort to complete remedial action on an initial group of properties during the 1983 construction season.

I am informed that there are a number of actions that must be completed as prerequisites to the start of the remedial action at Edgemont. These actions, together with a brief description and statement of current status, are as follows:

The first is a Cooperative Agreement with State of South Dakota. The Uranium Mill Tailings Radiation Control Act of 1978--Public Law 95-604--prescribes that the Department and the State in which remedial action is to be performed shall enter into a cooperative agreement setting forth the basis, such as cost sharing, land acquisition, etc., on which the remedial action is to be performed. The Nuclear Regulatory Commission is required to concur in this agreement.

The status of this is that the Department is in the process of modifying the model cooperative agreement which has been developed under the UMTRA Program to make it appropriate for the Edgemont situation. In the near future the draft cooperative agreement for Edgemont will be forwarded to the State of South Dakota for their review. Expeditious review and discussion of any required changes will be requested so that completion of the agreement will not delay the start of remedial action. Based on past experience, this item is the one most likely to present a problem with respect to schedule; typically the negotiation of the UMTRA Program cooperative agreements has required from 6 months to 1 year.

The second action is agreement with the TVA. It will be necessary to enter into an agreement under which the TVA agrees to accept the radioactive waste from the vicinity properties and dispose of it, along with the tailings from the processing site, in the repository being developed for that purpose.

The status of this is that the TVA has indicated informally its willingness to dispose of the waste from the vicinity properties, and no problem with formalizing the agreement is anticipated.

The third action concerns the National Environmental Policy Act or NEPA. The requirements of the NEPA as they relate to the cleanup of the vicinity properties must be fulfilled.

The status of this is that an Environmental Impact Statement or EIS covering the remedial action to be performed by the TVA at the processing site has been published. We believe that the NEPA requirements for the vicinity properties can be met with the preparation of an environmental report, or possibly an environmental assessment. No difficulty in completing this requirement in time to preclude interference with the start of remedial action is anticipated

The fourth action concerns designation. Public Law 97-415 requires the Secretary in consultation with the Administrator, the Commission and the State of South Dakota to designate contaminated properties for remedial action. Such designation is based on an assessment of radiological survey data obtained on a property in terms of the standards which have been promulgated by the Environmental Protection Agency.

The status of this is that the NRC has supported the radiological survey of approximately 970 properties in the Edgemont area, and the NRC staff has advised us that they will provide, within the next 2 months, reports on some 184 of these properties on which some contamination has been identified. We will begin our review of these reports upon receipt and will designate an initial group of properties for remedial action.

The last action involves remedial action contractors. The engineering of the remedial action and the onsite cleanup work will be conducted by contractors to be selected in accordance with established procurement procedures.

The status in regard to this is that we will determine the most effective contractor acquisition procedure, taking into account cost effectiveness, experience, availability, and other pertinent factors. We will make every effort to complete this process on a schedule consistent with the start of remedial action.

As indicated above, much of the planning and preparatory work required already is under way. A meeting among the principal parties who will be involved in the Edgemont Project was held at Tucson, Arizona, on March 1, 1983. At this meeting agreements were reached for expeditious handling of the above items among the several participants. With the cooperation of all participants, we anticipate that remedial action on a group of approximately 12 properties can be completed during 1983.

SUBCOMMITTEE RECESS

Senator COCHRAN. Thank you. The subcommittee will recess subject to the call of the Chair.

[Whereupon, at 2:57 p.m. Tuesday, February 22, the subcommittee was recessed to reconvene at 2 p.m. Wednesday, February 23.]

ENERGY AND WATER DEVELOPMENT APPROPRIATIONS FOR FISCAL YEAR 1984

THURSDAY, FEBRUARY 24, 1983

U.S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Washington, D.C.

The subcommittee met at 2:20 p.m. in room S–126, the Capitol, Hon. Mark O. Hatfield (chairman) presiding.

Present: Senators Hatfield, McClure, Mattingly, and Huddleston.

DEPARTMENT OF ENERGY

FEDERAL POWER MARKETING ADMINISTRATIONS

OPENING REMARKS

Chairman HATFIELD. The meeting will come to order.

The purpose of our hearing this afternoon is to receive testimony from the five Federal Power Marketing Administrations which are within the jurisdiction of the Energy and Water Development Subcommittee.

We extend a warm welcome to the Administrators of these agencies and look forward to receiving your status report and reviewing your 1984 budget request.

Also, we welcome Joseph J. Tribble, Assistant Secretary for Conservation and Renewable Energy, and Dr. Daniel Ogden, Director of the Office of Power Marketing Coordination within DOE, as our first witnesses today.

At this point, I would like to mention the subcommittee's traditional view of the power marketing agencies. It is still our view that Congress established these entities as independent agencies and that we hold the Administrators responsible for carrying out their programs in a businesslike manner. We expect the Department of Energy to assist and coordinate the activities, but not centrally direct or manage.

Bonneville, in particular, is unique. Since 1974, BPA has been self-financing. It does not require any appropriations, but comes before the subcommittee for budget review. Congress recently enacted legislation which greatly expanded Bonneville's responsibilities. In light of this action, it is crucial that we carefully review its budget request and make sure that adequate resources are available to them for implementing their new responsibilities.

We will receive your testimony first, Secretary Tribble, and then proceed with the Administrators of Bonneville, Western, Southwestern, Southeastern, and Alaska.

Gentlemen, you may proceed with your summary statements at this time. Mr. Tribble, I understand you are to go first. Please proceed.

STATEMENT OF JOSEPH J. TRIBBLE, ASSISTANT SECRETARY FOR CONSERVATION AND RENEWABLE ENERGY

INTRODUCTION OF WITNESSES

Mr. TRIBBLE. Mr. Chairman, I understand the schedule is somewhat limited and my comments will be very brief. I will just summarize one or two things that I think the subcommittee will be interested in.

First, I would like to introduce my colleagues today, and starting on my left is Bob Cross from Alaska; Harry Geisinger from Southeastern; Bob McPhail, Western Area; Peter Johnson, Bonneville; Dick Risk, Southwestern; and Dan Ogden, Office of Power Marketing Coordination.

FERC REVIEW OF RATES

Next, let me mention that last year, the Subcommittee on Energy and Water Development of the House Committee on Appropriations asked that we get with the Federal Energy Regulatory Commission and work out a procedure which would expedite their review of rates that we place in effect on an interim basis.

A joint task force composed of staff members from FERC, the PMA's, and my staff has reached substantial agreement on means to accomplish those objectives.

We believe that agreement on these issues will substantially reduce the delays in placing new rates in effect on a final basis.

The proposed agreement has been explained to the major customer representatives. We have received their comments and they will be carefully considered before the agreement is made final.

INTEREST RATES ON NEWLY INVESTED CAPITAL

Regarding interest paid to the Treasury on newly invested capital. Unless the Congress explicitly sets the rate of the interest by law, the policy has been to assign, as the interest rate on newly invested capital, the average yield during the preceding fiscal year on interest-bearing marketable securities of the United States which, at the time the computation is made, have terms of 15 years or more remaining to maturity. The rate is rounded to the nearest one-eighth of 1 percent.

The formula by which this interest rate was set did not accommodate the rapid rise in interest rates which took place in 1980 and 1981. Consequently, the formula has been revised. The revision has been announced in the Federal Register.

After receiving and evaluating public comments and making such changes as seem warranted, we expect that later this year we will issue a revision to the DOE order implementing the use of the new formula which will be effective on October 1, 1983.

Mr. Chairman, last year——

Chairman HATFIELD. Excuse me for interrupting at that point. Does that exempt Bonneville from that FERC regulation review?

Mr. OGDEN. That will not affect Bonneville.

Chairman HATFIELD. Does not affect Bonneville?

Mr. OGDEN. Correct, but the interest rate point that he was just making does.

Chairman HATFIELD. You are familiar with the language that we had in the report in which the committee very specifically stated that the House report language regarding FERC review on rates, power marketing agency rates should not apply to Bonneville Power Administration.

Mr. OGDEN. That is correct.

Chairman HATFIELD. Because of the fact we are setting that in statute.

Mr. TRIBBLE. Yes.

Chairman HATFIELD. So that is what you are saying?

Mr. TRIBBLE. Yes, where the interest rate is not set in the statute, there will be a modification. Of course, where it is set into the law it will not be altered.

Chairman HATFIELD. Thank you.

REVOLVING FUNDS

Mr. TRIBBLE. Mr. Chairman, last year you suggested that the Department consider proposing some form of self-financing for Alaska, Southeastern, Southwestern, and Western Area to provide them more flexibility.

We have discussed this, both as a group and individually, and find that the needs of the various PMA's are so varied that it is not likely that we could come forth with one recommendation that would cover all circumstances. So, it appears the best course of action will be to have each Administrator consider what might be most suitable for his own circumstances and come forth with a proposal.

I would be interested in the views of the subcommittee on such operating funds. It would be different for Southeastern, which has no transmission facilities, than it would be for the others, but if there is any general guidance that you could give us on that, we certainly would want to work with you on pulling that together.

Chairman HATFIELD. I raised that initially from an experience that we had at BPA. We authorized that about 5 years ago?

Senator MCCLURE. About that, yes.

Chairman HATFIELD. I would hope that we could review that in light of the advantages and perhaps hold down the costs that Bonneville has experienced. I introduced a bill originally to grant that to all the Power Marketing Administrations.

We did have hearings, but we did not get it out of committee.

Senator MCCLURE. That is right.

Chairman HATFIELD. But if it is applicable, then it seems to me we ought to look at that seriously. It may not be possible to have a uniform approach across the board.

Mr. TRIBBLE. Right. In some instances it may be an operating fund excluding capital expenditures. There are others that may very well include capital expenditures along with the operating funds.

Senator MCCLURE. Mr. Chairman?

Chairman HATFIELD. Yes.

Senator MCCLURE. I might add one comment.

I think one of the difficulties we may have in dealing with the overall problem is that in some ways, the Power Marketing Administrations are not as carefully circumscribed by statute as they might be as to what their functions are.

It has always been more or less an ad hoc decision through the appropriations process. There may be some reluctance to grant unrestricted financing authority in the absence of detailed statutory authority as to how it should be used.

We may have to look at how you write that statute as well as what kind of financing it accords.

Mr. TRIBBLE. Yes.

MANAGEMENT OF POWER MARKETING PROGRAMS

A change has recently been made in the organizational line of supervision within the Department of Energy for power marketing. Prior to January 23, 1983, the Administrators of all five PMA's reported to the Secretary through the Assistant Secretary for Conservation and Renewable Energy.

In recognition of the magnitude and complexity of the operations of Bonneville and Western, on January 23, 1983, the Secretary of Energy implemented a change in reporting so that these two largest Power Marketing Administrations now report directly to the Office of the Secretary, leaving the other three as they have been.

[The statement follows:]

STATEMENT OF JOSEPH J. TRIBBLE

Mr. Chairman and Members of the Committee. I am Joseph J. Tribble, Assistant Secretary for Conservation and Renewable Energy in the Department of Energy.

With me today are: Robert J. Cross, Administrator, Alaska Power Administration; Harry C. Geisinger, Administrator, Southeastern Power Administration; Richard B. Risk, Administrator, Southwestern Power Administration; Robert L. McPhail, Administrator, Western Area Power Administration; Peter T. Johnson, Administrator, Bonneville Power Administration; and Daniel M. Ogden, Jr., Director of the Office of Power Marketing Coordination. We are pleased to be here today to discuss with you our request for appropriations to carry out the responsibilities of the power administrations.

For those who may not be familiar with these responsibilities a brief explanation is in order.

The Federal Government operating through the Corps of Engineers and the Bureau of Reclamation builds and operates multi-purpose dams and generates electricity where it is economically and environmentally justified.

The Federal Government, operating through the Power Marketing Administrations, sells the power at wholesale to distribution utilities and certain large power users and in most instances transmits its electric power over its own high-voltage transmission lines.

In selling power, the Power Marketing Administrations, according to law, give preference to publicly and cooperatively-owned utility systems. The Tennessee Valley Authority has similar responsibilities but is a separate Federal entity.

The following table depicts the magnitude of the operations of the five Power Marketing Administrations.

POWER MARKETING SALES AND REVENUES

Power Administration	Kilowatt-Hours Sold 1982 (Billions)	Revenues 1982 (Millions)	Estimated Revenues 1983 (Millions)	Estimated Revenues 1984 (Millions)
Alaska	0.3	$ 4	$ 4	$ 6
Bonneville	83.1	1,337	2,244	2,814
Southeastern	6.9	61	64	84
Southwestern	4.6	67	65	92
Western Area	36.1	358	454	546
TOTALS	131.0	$1,827	$2,831	$3,542

In carrying out their functions, the Power Marketing Administrations:

- Enter into contracts for the sale and purchase of power.
- Construct, operate and maintain transmission lines, substations, switchyards, and attendant facilities, and
- Develop rates adequate to repay the Federal investment with interest.

The Subcommittee on Energy and Water Development of the House Committee on Appropriations in its report recommending appropriations for the Power Marketing Administrations for FY 1983, directed the Department of Energy, the power administrations, and the FERC to enter into an agreement which would accomplish five specific objectives to insure prompt and effective rate review.

A joint task force composed of staff members of the FERC, the power administrations, and my staff has reached substantial agreement on the means to accomplish the five objectives listed by the Subcommittee and has prepared a Memorandum of Understanding which is now before the principals for review. First, the Memorandum sets forth the criteria which will establish that the rates are adequate and identifies the documents which the power administrations will submit in support of a rate filing. Second, it provides that the appropriate DOE official will certify that the rates conform to the need to encourage the most widespread use at the lowest possible rate consistent with sound business principles and that the rate filing contains all of the documents agreed upon. Third, it clarifies FERC's role in confirming and approving power marketing rates and FERC agrees to accept the certification of the appropriate DOE official that the proposed rates meet the above criteria and that the filing contains all of the agreed upon information. The Commission reserves the right to seek additional relevant information Fourth, the appropriate DOE official will continue to place rates into effect on an interim basis before submitting them to FERC for confirmation and approval. Fifth, the FERC will make every effort to complete each rate review within six months.

In addition, provisions were included to streamline the process of responding to remanded or disapproved rates. The Assistant Secretary and the power administrations also are to try to distribute their rate filings as evenly as possible to reduce the burden on the FERC staff and to review contracts to eliminate provisions which inhibit the freedom of action of Administrators in proposing rate adjustments as promptly or as often as needed. Additional arrangements were agreed upon to promote early and effective consultation between the staffs.

We believe that agreement on these issues will substantially reduce delays in placing new rates into effect on a final basis. The proposed agreement has been explained to the major customer representatives. We have received their comments and they will be carefully considered before the agreement is made final.

Regarding interest paid to the Treasury on newly invested capital, unless the Congress explicitly sets the rate of interest by law, the policy has been to assign as the interest rate on newly invested capital the average yield during the preceding fiscal year on interest-bearing marketable securities of the United States which, at the time the computation is made, have terms of 15 years or more remaining to maturity. The rate is rounded to the nearest one-eighth of a percent. The formula by which this interest rate was set did not accommodate the rapid rise in interest rates which took place in 1980 and 1981. Consequently, the formula has been revised and the revision has been announced in the Federal Register. After receiving and evaluating public comments and making such changes as seem warranted, we expect that later in the year we will issue a revision to CE Order 6120.2 implementing the use of the new formula effective October 1, 1983.

Last year, Senator Hatfield suggested that the Department consider proposing some form of self-financing for the Alaska, Southeastern, Southwestern, and Western Area Power Administrations to provide them at least some of the flexibility enjoyed by the Bonneville Power Administration. This suggestion was discussed with the power administrators as a group and individually. The needs are so different among them that we have agreed that a common pattern would not accommodate these needs. It appears that the best course of action will be to have each administrator develop his own proposal, adapted to fit the needs of his administration, and to come forward with his proposal when he is satisfied that it has the support of his customers and the Congressional delegation from his region. For example, the Southeastern Power Administration, which has no transmission system, would be adequately served by a simple operating fund which would permit the Administrator to use his revenues to pay his wheeling and purchased power bills monthly before making his payments of interest and capital to the Treasury. Western, on the other hand, which has an extensive transmission system and an obligation to cooperate in the development of a Western grid system with other electric utilities in its far-flung territory, has a continuing need to invest capital in transmission facilities, and may very well need some form of borrowing authority, like Bonneville.

We are, therefore, proceeding cautiously to identify the best arrangements for each administration, to secure proper support for such a change for each, and then to come forward at the appropriate time with a proposal. We are not yet ready at this time to recommend action for any of the power administrations.

A change has recently been made in the organizational line of supervision within the Department of Energy for the Power Marketing Administrations. Prior to January 23, 1983, the Administrators of all five PMA's reported to the Secretary through the Assistant Secretary of Conservation and Renewable Energy.

With passage of the Pacific Northwest Electric Power Planning and Conservation Act in November 1980, Bonneville assumed a much broader role as a Federal Government entity in planning for and meeting the current and long-term power requirements of the Pacific Northwest. This role includes greater involvement with State and local governments, other government agencies, Indian Tribes, and environmental interests as well as public/private utilities and customer groups, both residential and industrial.

Bonneville operates on the basis of self-financing authority and received new borrowing authority through the Northwest Power Act. Thus, it requires no Federal appropriation of funds. The operating characteristics of WAPA are similar to Bonneville due to the large service area (parts of 15 states) of WAPA and unique political environment within which it must function. In addition, approximately one-third of WAPA's activities are funded directly from revenues in a manner similar to the Bonneville revolving fund authority.

Together the two large PMA's operate transmission and marketing systems that include portions of 17 states served by 29,130 circuit-miles of government-owned transmission lines (94 percent of total miles for all PMA's) over which 119.2 billion kilowatt-hours of electricity were delivered in 1982. Their combined employment in FY 1982 was 3,968 and total operating costs exceeded $1.5 billion.

In recognition of the magnitude and complexity of operations of Bonneville and Western the Secretary of Energy implemented a change in reporting on January 23, 1983, so that these two largest Power Marketing Administrations now report directly to the Office of the Secretary.

Mr. Chairman, this concludes my testimony.

The individual Administrators of the Power Marketing Administrations will discuss their budget requests. All of us will be pleased to respond to any questions you may have.

Mr. TRIBBLE. This concludes the items that I had prepared to comment on. Of course, all of the Administrators have their statements to make, and if you choose, we would start on my left and go down the line.

Chairman HATFIELD. With Bonneville first? [Laughter.]

Mr. TRIBBLE. If you would prefer.

Chairman HATFIELD. You haven't been around here very long, have you? [Laughter.]

Mr. TRIBBLE. It will be hard to do both, but if you want to hear Bonneville, we will start on my right. [Laughter.]

Chairman HATFIELD. I like to do things alphabetically. [Laughter.]

Mr. TRIBBLE. All right.

What about Alaska?

Senator MCCLURE. Alaska is first. [Laughter.]

Chairman HATFIELD. I know that, but we don't give them a very long time to testify. [Laughter.]

Senator MCCLURE. We will make an exception.

Chairman HATFIELD. However you wish to proceed.

Mr. TRIBBLE. Really, it is your option.

This morning, we simply just went down the table as we are. We would be pleased to——

Chairman HATFIELD. On the House side?

Mr. TRIBBLE. Yes.

Chairman HATFIELD. Well, we like to do things differently here. [Laughter.]

Senator MCCLURE. Before we get into the specific marketing subdivisions, could I ask a couple of questions that are general in nature?

MARKET VALUE PRICING FOR FEDERAL POWER

Last year, pursuant to the Niskanen report, there was a beginning of market value pricing for Federal power. This committee and the Congress as a whole wrote in a restriction on that saying that no money should be expended to further that operation.

Is that still our understanding of the situation?

Mr. TRIBBLE. Yes, it is.

Senator MCCLURE. I would hope if there is any thought of changing the administration's response to that directive from the Congress that this committee would be notified very early rather than to see any attempt made to make a change without having first consulted the committee.

Mr. TRIBBLE. Certainly. Now, I must say that that was completely out of my purview and I would not presume to be able to direct their efforts.

But if we are involved, we will certainly let you know.

Senator MCCLURE. And the second rather general question—and I hope even though it may not be within your purview, you can communicate that to others within your department——

Mr. TRIBBLE. Yes.

Senator McClure [continuing]. So we don't have to cross all the "t's" and dot all the "i's," if there are any "t's" and "i's" in DOE.

REPAYMENT TO THE TREASURY

The second question was with respect to the repayment to the Treasury of obligations. I think we have a situation that exists in the country today when many, many business entities find cash flow quite different and it was presumed that I would hope that every one of the agencies or units that are involved can inform us as a matter of fact of the change in business activity within their region as it affects cash flows to the point where the repayment to Treasury schedule is a major problem today in internal operations.

We may have to take a separate and different look at those. It may be the same in every region. It may be different in different agencies, but we ought to be informed if there is a problem so that we can react to it.

Mr. Tribble. I believe that you will find that it is different in the various PMA's. I may be going out on a limb, but I believe all the Administrators are perhaps in a position to give you an answer to that today.

Senator McClure. All right.

Thank you, Mr. Chairman.

Chairman Hatfield. Do you have any other questions?

Senator McClure. No.

BONNEVILLE POWER ADMINISTRATION

STATEMENT OF PETER T. JOHNSON, ADMINISTRATOR,

Chairman HATFIELD. Mr. Johnson?

Mr. JOHNSON. Thank you, Mr. Chairman, and members of the committee.

My name is Peter Johnson. I am the Administrator of the Bonneville Power Administration.

Thank you for the opportunity to submit our proposed fiscal year 1984 budget.

I have a statement to be submitted for the record, but I have several points that I would like to make.

Chairman HATFIELD. The entire statement will be placed in the record, Mr. Johnson.

Mr. JOHNSON. Thank you.

The budget for fiscal 1984 proposes a total of $2.7 billion. This is an increase of some 20 percent over fiscal 1983. A large part of the increase is due to Bonneville's growing responsibilities under the Regional Power Act.

In addition to the $3.3 billion that Bonneville has already returned to the Treasury, Bonneville made payments of $282 million in 1981 and some $286 million in 1982.

PACIFIC NORTHWEST ENERGY SITUATION

The energy situation in the Pacific Northwest has changed drastically since I testified before the subcommittee 1 year ago.

At least four major developments have had a profound impact on Bonneville's financial affairs.

First, Bonneville issued its first 20-year regional load forecast this last April indicating that the Northwest's energy requirements would grow at an annual rate of about 1.6 percent as compared to an earlier projection by the utilities in the region of some 3 percent. In the past few months, the 1.6-percent rate of growth has been revised downward.

This represents a dramatic slowdown in the demand for electricity in our region for the next 5 to 6 years and will reverse what was a deficit to an actual and projected surplus of up to 1,000 megawatts through most of the decade.

Second, earlier in the year, the Washington Public Power Supply System delayed completion of the Washington nuclear project No. 1 because of financing difficulties and because of pressure on Bonneville Power Administration rates.

Third, the economic recession, deeper and more prolonged than expected, cut sharply into the demand for electricity and Bonneville's revenues. Revenues from all customers were less than expected. For example, Northwest aluminum plants consume almost a third of the electricity on the Bonneville system. Our revenues from these customers last year were about one-third less than we forecast and the forecast was below their contracted demand.

Fourth, during the year we continued to implement the major provisions of Public Law 96–501, the Pacific Northwest Electric Power Planning and Conservation Act, more commonly known as the Regional Power Act. Mr. Chairman, these are the significant developments of the past year. The current year has also brought its share of important changes which include—and these were just coming to light in the last few weeks—a lower near-term forecast of the demand for electricity which is directly attributable to the recession; two, a continuing weakness in the world markets for aluminum and the prospect that higher power rates will worsen the industry's situation and add significantly to the region's surplus of power; and third, continuing downward pressure on cash revenues due to reduced firm power sales during the entire year.

Finally, the lack of interest on the part of the Southwest utilities toward the acquisition of firm power from the Northwest at adequate prices.

CHANGED REVENUES PROJECTIONS

The changed circumstances that I have just described have caused Bonneville's revenues to fall below projections. By the end of January 1983, roughly a third of a way into this fiscal year, our revenues were down some $96 million below projections. This is offset by $76 million in reduced costs and, as a result, we have roughly a $20 million net underrun at the present time.

Because of these changes, we are going through a total review of the program plans and costs for 1984 and 1985 which will be included in our next rate increase which will be effective on November 1, 1983.

We are delaying the preliminary announcement of our next rate increase from February 28, which is just this next Monday, until March 28 to enable us to complete this assessment of these most recent changes. We anticipate major changes to result from this effort. When we have completed this reevaluation, we will appropriately inform this subcommittee on the reductions and changes we propose to make.

Despite a potential 1983 revenue shortfall I want to assure this committee that Bonneville is continuing to take steps that will enable us to make the total planned repayment to the Treasury by 1985 as reported to the committee this last year. In the preliminary rate filing process now underway, we are planning to include amounts to recover the full cumulative deferral of some $152 million, as well as the amortization payments of at least $316 million between now and 1985.

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

Let's talk about the supply system a little bit on a couple of projects. Bonneville has contracted to acquire the capability of three nuclear generating plants on a net billing basis: One hundred percent of No. 1, 100 percent of No. 2, and some 70 percent of No. 3. Bonneville is obligated to pay debt service on bonds sold to finance construction of these projects. Since early 1982, Bonneville has focused on completing unit 2, which will be done by February 1984.

The construction of this project and WNP-3 has been going extremely well in the last year. WNP-2 is about 97-percent complete. WNP-3, which is to be finished in 1986, is almost 70-percent complete at this time. The completion date for unit 1, which is the one that has been delayed, is now scheduled for 1991.

The supply system is, however, encountering financing problems. It needs approximately $150 million to complete WNP No. 2 and some $961 million to complete and finish unit 3. I believe the supply system and Bonneville will be successful in dealing with current impediments to conventional financing, thus allowing these net billed projects to proceed on schedule.

CONSERVATION PROGRAM

The Regional Power Act directs Bonneville to treat cost-effective conservation as the region's highest priority resource and authorizes a comprehensive conservation program. We have a commitment to this goal. Bonneville's conservation program is tailored to insure a high level of conservation savings is achieved to prevent the occurrence of projected deficits of energy at the end of this decade.

We will, at the same time, keep near-term conservation expenses as low as we possibly can within the context of prudent utility practice.

REGIONAL PLANNING COUNCIL

With respect to the new regional planning council created by the Northwest Power Act, it is gratifying at this time to report that the Pacific Northwest Electric Power Planning and Conservation Council has been established and is now functioning. Bonneville and the council will work closely together to achieve mutual objectives for the region.

The recently issued draft of the council's energy plan is now being reviewed throughout the Northwest; the council has also initiated a program to enhance and protect fish and wildlife as required by law. The costs of this fish and wildlife program and the council's operating expenses are in Bonneville's budget exactly as they were presented to Bonneville by the council.

This completes my opening remarks. I would be happy to answer questions that you may have.

[The statement follows:]

STATEMENT OF PETER T. JOHNSON

Mr. Chairman and members of the committee:

Thank you for this opportunity to present Bonneville Power Administration's (BPA) budget for Fiscal Year 1984. This is my second budget appearance as BPA Administrator.

FISCAL SUMMARY

For FY 1984, BPA's program will require budget obligations of $2,714.3 million, an increase of $449.1 million, or approximately 20 percent compared to FY 1983's program. This increase reflects BPA's growing responsibilities in the region's electric power supply system. Total outlays are estimated to be $2,723.7 million. Program financing from revenues, borrowings, and other receipts is estimated at $2,784.2 million, which is forecast to result in net outlays of -$60.5 million for the fiscal year.

Although this budget proposes an increase in FY 1984, it should be noted that this budget reflects reductions of about 10 percent in both FY 1983 and FY 1984 from estimates presented a year ago. This is due to our continual attention to cost reduction opportunities and the adjustment of budget requirements to changing economic conditions and financing decisions of those in the region who are sponsoring new generating resources.

BPA, THE AGENCY, ITS MISSION AND PROGRAM

BPA is the Federal electric power marketing agency in the Pacific Northwest, a 300,000-square-mile service area that encompasses Oregon, Washington, Idaho, western Montana, and small portions of adjacent western states in the Columbia River drainage basin. BPA markets hydroelectric power from 30 Corps of Engineers and Bureau of Reclamation projects, as well as thermal energy from non-Federal generating facilities in the region. BPA also markets and exchanges surplus electric power interregionally over the Pacific Northwest-Pacific Southwest (PNW-PSW) Intertie with California, and in Canada over interconnections with utilities in British Columbia.

BPA constructs, operates and maintains the Nation's largest high-voltage transmission system (13,380 circuit-miles of transmission line and 363 substations at the end of FY 1982). This permits the coordination of the Federal electric power program with the region's public and investor-owned utilities to obtain the operating economies and investment benefits of a single regionwide utility.

Public Law 93-454, the Federal Columbia River Transmission System Act of 1974 (Transmission Act), placed BPA on a self-financed basis and brought it under provisions of the Government Corporation Control Act, with the intent that BPA have the flexibility necessary to fulfill its regional utility mission in a businesslike manner. BPA has ongoing "revolving fund" authority to finance its operations with revenues from its power sales. Rates to generate these revenues are set after extensive public hearings in which all parties closely scrutinize program cost data. BPA also has authority to borrow funds from the Treasury to finance its capital investments. In exchange for continuity of funding and the autonomy provided by the provisions of the Transmission Act, the region's ratepayers pay government corporation rates for borrowing.

With the passage in 1980 of Public Law 96-501, the Pacific Northwest Electric Power Planning and Conservation Act (Regional Act), BPA's role and responsibilities were greatly expanded. The Administrator is now responsible for meeting the net firm load growth of the region, and has authority and is mandated to invest in cost-effective, regionwide energy conservation and to acquire generating resources to meet these requirements. New Treasury borrowing authority has been provided for these conservation and renewable resource acquisitions. Other areas in which BPA acquired new responsibilities under the Regional Act include fish and wildlife, public involvement, and energy exchanges with investor-owned utilities. These exchanges spread the benefits of relatively low-cost Federal power to their residential and small farm consumers and reduce the differential between public and private power rates in the region.

REPORT ON REPAYMENT

Last year the Committee expressed concern that BPA's rates be sufficient to meet our repayment obligations and specifically requested that I report on this matter. I would like to take this opportunity to provide you with that report.

At last year's hearings we indicated that, while the cumulative deferral of interest payments to the Treasury was expected to reach $226 million by the end of FY 1982, we expected revenues beginning in 1983 to be sufficient to fully repay the $226 million interest deferral plus the full scheduled amortization of $316 million by the end of FY 1985. On October 1, 1982, we raised our average wholesale electric rates by 58% (a revenue increase of $816 million in FY 1983) to seek to assure making these planned payments.

First, I can report that the outcome of our fiscal operations for Fiscal Year 1982 was less severe than we estimated last March. Although the economic conditions in the Pacific Northwest continued to be adverse, we were able to hold our deferral of interest payments to $152 million, or $74 million less than projected.

However, because of these same adverse economic conditions, FY 1983 is not expected to provide us the level of revenues we had anticipated. While we don't have final estimates as yet, it appears that general economic conditions, plus the impact of the depressed aluminum market worldwide on our sales to industrial customers, means that revenues will be less than originally planned for the year.

While FY 1983 may not provide us the level of revenues we had expected, I want to assure the Committee that BPA is continuing to take steps to enable us to make the total planned payments to the Treasury by 1985 as reported to the committee last year.

Our major emphasis will be on ensuring that our next rate filing will provide sufficient revenues to meet our obligations. In the preliminary rate filing process now underway, we are planning to include amounts to recover the full $152 million cumulative interest deferral as well as amortization payments during the FY 1983-85 period of at least the $316 million we identified to the committee last year.

We are taking other steps to insure attainment of our repayment commitment. Specifically, we are: (1) increasing power marketing efforts in the Southwest to enhance revenues, (2) insuring that we continually reassess program requirements and costs at every opportunity, (3) improving financial management analysis and information reporting to increase cost control, and (4) attempting to identify feasible and practical means to enhance our fiscal flexibility through such measures as partial revenue funding of capital investments, alternative financing mechanisms for energy conservation and other resource acquisitions, and improved and accelerated billing procedures.

In summary, we fully expect to set our rates for the period FY 1983-85 to be sufficient to provide full repayment of the $152 million interest deferral. Our preliminary rate study will also provide for payment of at least $316 million in amortization during that period, for a total payment of at least $468 million.

CHANGED ECONOMIC REALITIES AND BPA SALES

BPA's financial situation reflects the tremendous and pervasive changes in the region's electric energy sector in the past few years, and throughout the Nation's electric utility industry as it copes with rising energy costs and declining energy demand. During the past three years, we have seen the electric energy situation in the Pacific Northwest change from one of anticipated shortages--up to 2,000 megawatts (MW) (two thermal plants)--to one of both near-term and longer-range surpluses. The region is expected to have a firm energy surplus of 500-1,000 MW through 1990. Between one-half and two-thirds of this surplus is forecast to be on the Federal system.

BPA revenue shortfalls in FY 1982 occurred throughout our customer classes. Revenue from the sale of industrial firm power to BPA direct-service industrial customers declined the most from forecasts as poor economic conditions reduced the demand for aluminum. The rapid increase in power costs for BPA's aluminum customers, who account for one-third of the Nation's primary aluminum production capacity, is adding to their financial burdens, causing some of them to examine geographic relocation. The depressed aluminum economy caused actual 1982 revenues from those customers to be one-third below forecasts. As of last December, our direct-service industrial customers were operating at about 55 percent of their average maximum load. Firm power sales to preference customers also under-ran forecasts, also reflecting low economic activity and conservation of energy by consumers.

Nonfirm energy sales revenues increased substantially in FY 1982 compared to forecasts, due to abundant streamflows and reduced demands for firm energy. But, because energy ordinarily sold as firm energy, had to be marketed at nonfirm rates to achieve sales, it generated less revenue. BPA was able to sell only 740,500 megawatt-hours (MWH) of surplus firm power to California utilities last year, but we set a record of 15 million MWH nonfirm sales in the same period.

Also, the shortfall in FY 1982 revenues from sale of energy sold from certain newly acquired resources was almost as great as the shortfall in industrial sales revenues. This came about because BPA was unable to market this new firm energy due to lower than expected demand in the region and the relatively high cost of this power, which reduced its marketability outside the region. In general, revenue operations to date in FY 1983 are continuing much of these trends.

GREATER RESPONSIBILITIES

BPA's new and expanded responsibilities under the Regional Act have increased fiscal requirements, exacerbating revenue shortfalls. From FY 1982 to FY 1984, total program obligations are budgeted to increase from $1.5 billion to $2.7 billion. During this period, our gross costs for the residential energy exchange with investor owned utilities, which is discussed further on in this statement, will triple in cost and in FY 1985 exceed $1.0 billion. Despite the delay of WNP 1, Supply System net-billing requirements will almost double by FY 1984. In addition, there are significant increases in program requirements of other Regional Act mandated responsibilities, most notably in energy conservation, resource acquisition, fish and wildlife, and support of the Pacific Northwest Electric Power Planning and Conservation Council (Regional Council).

The change from an energy deficit situation to an energy surplus conditon, however, has reduced the rate of fiscal growth of some programs. Energy conservation has become less urgent in the short run, so BPA's focus has changed to assuring long-term savings from its regionwide conservation programs, although we are continuing to acquire all cost-effective conservation as the Regional Act requires. Also, with declining load growth, BPA's construction program has been modified in response to the changing load-resource situation.

THE SUPPLY SYSTEM SITUATION

When the Regional Act was passed the region was engaged in one of the most ambitious nuclear construction programs in the Nation. The Washington Public Power Supply System (Supply System) was building five nuclear plants. Of these, BPA contracted to acquire all the generating capability of WNP 1 and WNP 2, and 70 percent of WNP 3. Four utilities have acquired the remaining 30 percent of WNP 3, and 88 utilities are sponsoring WNP 4 and WNP 5. BPA has no financial involvement or oversight role in WNP 4 AND WNP 5.

These construction plans were based upon meeting historic load growth trends in the region which indicated a regional energy shortage of up to 2,000 megawatts of energy if low streamflows and limited hydro-generating capacity were to occur in any year of the 1980's.

By May of 1981, the Supply System beset, like other sponsors of nuclear plants, with a history of cost escalation and schedule delays, found it could no longer obtain sufficient bond market financing to continue the scale of its construction program. Economic forces which have reduced energy needs in the region, and rising finance costs have ultimately led the Supply System to terminate construction of WNP 4 and 5 and to defer completion of WNP 1. Uncertainties about continuing construction plans due to litigation and about the Supply System's ability to successfully raise needed bond financing are causing the Supply System and BPA to consider delay of WNP 3, which is now scheduled for completion in December 1986. This project is currently ahead of its construction schedule. If this project is delayed, the Supply System active construction program will focus in the near term on WNP 2, scheduled for completion early in 1984.

STRATEGIC PLANNING FOR FISCAL INTEGRITY

Last year, we described to the committee BPA's strategic planning process to insure the agency's fiscal integrity while implementing the Regional Act. This past year, we have intensified this commitment to insure that our responses to these changing circumstances best serve the ratepayers of the Pacific Northwest.

The process described to the Committee last year has been enhanced and is rapidly becoming a BPA institution. More importantly, in the face of the dynamic changes in the region's electric energy picture this past year, we have not abandoned our strategic planning responsibilities to the press of outside events. Rather we made these the basis of our strategic choices.

Our strategic planning process has involved the use of a business consultant, top management interactive strategic planning, and a balanced system of strategic guidance from management to direct the agency toward its most pressing challenges.

With this strategic planning process, we have reaffirmed our basic mission and delineated our strategic choices and key objectives. Especially important, the process has provided the necessary integration of our program planning and budgeting and our ratemaking processes. The strategic planning process has dramatically improved the financial management awareness of all BPA managers and employees through its documentation and communication of planning needs, action strategy, and resource allocations to strategic choices and key objectives.

BPA's fiscal integrity is based upon attention to three interdependent concerns--cost minimization, adequate rates, and effective planning. We have conducted two comprehensive cost reductions in the past year involving all BPA programs, looking at both discretionary and nondiscretionary cost elements and seeking to identify revenue enhancement opportunities. Although our new Regional Act responsibilities have increased the fixed costs component of our budget from about 70 percent to almost 90 percent, we have reduced costs, restrained future cost growth, and we are instilling an indepth appreciation by all employees of our need for fiscal integrity and their role in it.

With a base of minimum, prudent utility cost and a commitment to continued emphasis on fiscal integrity, we are best able to set rates for the sale of energy and transmission of power that fully cover our costs, yet are held to a minimum to achieve our other objectives. As energy costs become more controversial, BPA has expanded its rate and repayment study processes to provide for more comprehensive analysis and increased, more detailed communication with customers and the public.

ACHIEVEMENTS IN FY 1982

Although FY 1982 brought adversity and problems, our strong strategic planning process enabled us to manage our situation and achieve critical positive results. While responding positively to the impacts of the changing economy in the Northwest, BPA also undertook its new power supply role aggressively. BPA has been implementing its new responsibilities under the Regional Act with a central concern for maintaining the agency's fiscal integrity and improving our flexibility to respond to changing economic conditions. We resolved to cope with the changes that have beset the region this past year or so with equal commitment to this goal.

A major accomplishment was BPA's initial energy exchange with investor-owned utilities, who serve more than 60 percent of the region's residential customers. BPA energy exchanges, begun in October 1981, have provided rate relief totaling $214 million to these consumers. These exchanges together with a 1981 rate increase produced a new first for BPA--annual revenues exceeded $1 billion in FY 1982.

In accord with the Regional Act, BPA offered long-term power sales contracts to all the region's utilities in response to its new role of meeting the region's net load growth requirements. All but six of our 143 customers signed the contracts by August 1982, assuring that BPA can implement the new Regional Council's energy plan, which is to be issued in April 1983 and revised at least every 5 years.

We negotiated short-term energy conservation contracts to make a range of regionwide conservation services available through the utilities. These are part of a long-range conservation goal of a net load reduction of 1,000 average megawatts annually by 1990. This amount of energy is more than the output of a large nuclear powerplant, but can be acquired in a shorter time frame than would be required to construct a large nuclear powerplant. With the short-term agreements in place, we have begun negotiation of long-term conservation contracts and expect to have them in effect in FY 1984.

The Regional Act provided for a truly regional electric power planning institution based upon public participation, and created an organization, the Regional Council, to formulate the region's electric energy plan. While the Council has moved expeditiously to carry out its legislative mandates, the press of changing conditions caused BPA to accelerate its own electric energy forecast to provide data for conservation and generating resource decisions pending completion of the Regional Council's energy forecast and plan.

BPA issued its first regional load-resource forecast in July 1982. Previously BPA used those of the Pacific Northwest Utility Conference Committee (PNUCC), an inter-utility forecast coordinating group. In preparing our forecast, we involved energy and economic consultants, utilities in the region, public interest groups, and the citizenry of the Pacific Northwest. The result was in effect a "new discovery" for the region. BPA's forecast showed an annual load growth with a mid-range estimate of about 1.6 percent, half of the growth rate of the previous PNUCC forecasts, which themselves had been gradually reduced by half over a 6- to 7-year period in response to steadily declining energy growth rates. More significantly, BPA's fore- cast predicted firm energy surpluses in the out-years, not deficits. With this forecast available, we were able to evaluate our resource alterna- tives in the framework of our strategic plans. On this basis, we recommended that the Supply System defer completion of one net-billed plant (WNP 1). This forecast and our strategic planning process have enabled us to perform our oversight objectives in a timely, businesslike manner and manage our response to rapid change in the region.

FY 1984 BUDGET PROGRAM HIGHLIGHTS

BPA's budget for FY 1984 supports our goal of fiscal integrity and incorporates a capital investment strategy intended to increase our fiscal flexibility. It is a product of our strategic planning process which has reduced costs and allocated fiscal resources to accomplishment of our integrated strategic choices and supporting key objectives. It has been formulated to manage the agency's response to recent changes in the region's energy situation and economy, and provides a basis for insuring our future fiscal integrity. The interplay of changes in the region's energy and economic situation and BPA's growing responsibilities are reflected by the growth in our budgetary requirements from $1.5 billion in FY 1982, the first full fiscal year after passage of the Regional Act, to $2.7 billion in FY 1984 and the increase in revenues for the period from $1.4 billion to $2.8 billion.

FY 1984 obligations by program are compared below with the FY 1983 program.

	FY 1983	FY 1984
	($000)	
Resource Planning, Acquisition, and Oversight	1,373,700	1,837,800
Energy Conservation	253,500	145,100
System Planning and Construction	218,700	216,900
Operation and Maintenance	129,000	163,200
Reimbursable	88,500	95,400
Interest	109,900	155,900
Associated Project Costs	91,900	100,000
Total Programs	2,265,200	2,714,300

A substantial part of the $449 million increase in BPA's budget from FY 1983 to FY 1984 provides for new and expanded programs directly related to the Regional Act — notably, resource acquisition, fish and wildlife support, and BPA's residential energy exchange with investor-owned utilities. The remaining increase is due to increased costs for existing programs and inflation. Budgeted costs and programs have and will continue to be tested against BPA's commitment to fiscal integrity.

Resource Planning, Acquisition, and Oversight. The objectives of this program are the orderly planning, acquisition, and oversight of reliable, cost-effective, environmentally acceptable resources. This program includes resources purchased prior to the Regional Act, which are needed to serve BPA's portion of the region's forecasted net electric load requirements which cannot be met through cost-effective conservation. Total FY 1984 funding of $1,837 million for the program is two-thirds of BPA's total budget for the year. Increased funding of $464 million is proposed, primarily to provide for increased net-billing of the Supply System projects debt service, and increased levels of residential energy exchanges with investor-owned utilities to provide rate relief for their residential and small farm consumers.

Net-billing costs for the three Supply System projects will require approximately $760 million in FY 1984, an increase of $145 million over FY 1983's costs. Of special note is the assumption in this budget that the Supply System's WNP 2 will come on line and be available for revenue operations in FY 1984 as currently scheduled. This will be the first completion of the net-billed projects the Supply System has under construction.

BPA has budgeted $914 million for the residential power exchange in this resource program. This is an increase of more than $300 million over FY 1983's funding level. By FY 1984, BPA's rate relief program costs will exceed its Supply System net-billing requirements. Rate relief under the Regional Act will be "ramped in" to the full level authorized by the Regional Act by 1985.

Energy Conservation. This program provides for assessing the potential for energy conservation in the region, and for the developing and implementing those cost-effective measures which will reduce the level of loads BPA must serve with generating resources. The total cost of BPA's conservation program in FY 1984 is $339 million, an increase of $52.6 million from FY 1983. You will note that the table above indicates reduced BPA budget costs for energy conservation. This is because the budget assumes external financing by non-Federal entities in the region will be obtained and will increase from $32.9 million in FY 1983 to $193.9 million in FY 1984. Thus, the fiscal level of the program actually increases, but BPA's FY 1984 capital requirements do not. This alternative financing, whereby other entities will fund conservation capital investments in BPA energy conservation programs and BPA will pay annual debt service costs, is a key element in our changing capital investment strategy. It increases the financial range of BPA's investment and may reduce energy cost to ratepayers. This in turn increases BPA's fiscal flexibility. BPA's energy conservation program reflects the near-term period of forecasted resource surpluses, and thus concentrates on proceeding with energy conservation planning and acquisitions at a deliberate pace, stressing continuity of progress and developing the capability to enhance long-range conservation goals.

Transmission System Planning and Construction. The objectives of this program are the planning, design, and construction of a safe, reliable, efficient transmission system to enable BPA to maintain reliable, economic service to customers, integrate new generation, meet load growth, and provide transmission capacity for wheeling and energy exchange. Perhaps more than any other traditional BPA budget program, the construction program best reflects new priorities and realities in the region's electric energy supply system. For FY 1984, this program will require about the same funding level as in FY 1983, which is less than 10 percent of BPA's total fiscal resources for the year. Before the decline in regional energy growth, the construction program required a much larger part of BPA's budget. Estimated obligations for FY 1984 are $216.9 million, compared to FY 1983's requirement of $218.7 million.

The construction program is continually adjusted to the dynamics of the load-resource situation confronting BPA and to ensure that facilities and their energization schedules are essential and cost effective. The budget identifies seven cancellations from the program due to reduced load growth. Also, as our budget indicates, BPA may propose budget adjustments in FY 1983 and later years to accommodate changing fiscal requirements for its Colstrip integrating transmission facilities, depending upon the environmental decisions BPA will be making.

The construction program has been funded by U.S. Treasury borrowings pursuant to the Federal Columbia River Transmission System Act. BPA estimates that this authority will be exhausted by mid-FY 1984 and the budget includes a request for $1.25 billion to replenish this authority. BPA must have its borrowing authority replenished to continue its ongoing multiyear construction program and to assure the region's utilities and their consumers that BPA has the financial capability to meet its responsibilities to provide reliable, economic service to its customers and to finance new Regional Act responsibilities authorized to be funded from this source. This authority is also recommended by the Department of Energy and has been included in the President's FY 1984 budget.

Operation and Maintenance. This program provides for the operation and maintenance of BPA's transmission system. It also provides funding for power management activities of power scheduling, rate design, and contract negotiation. The mitigation of the adverse impacts of power operations on the fish and wildlife resources of the Columbia River and its tributaries is a substantially expanded component of this program. Lastly, this program includes funding for the administrative and operating expenses of the Pacific Northwest Electric Power and Conservation Planning Council established by the Regional Act with responsibilities to prepare a regional energy plan and a fish and wildlife program.

FY 1984's requirement of $163 million for the operation and maintenance program is $34 million above the FY 1983 funding level, primarily due to increased fish and wildlife costs as BPA implements the Regional Council's fish program. Other increases are associated with the increased workload in system operation and maintenance and power scheduling and marketing as the points of electrical interconnections on the system become more numerous and the system's complexity increases.

Reimbursable. This budget program includes funding for the acquisition of energy, or the provision of other services by BPA under various trust and reimbursable arrangements, for which BPA is fully paid by benefiting entities. This program is budgeted at $95 million in FY 1984, compared to $88 million for FY 1983.

Interest Expense and Associated Project Costs. The Interest Expense program includes the funding of interest expense on Federal borrowings for the transmission system construction and energy conservation investments. Associated Project Costs includes payments to the Treasury for operation and maintenance expenses of Bureau of Reclamation and Corps of Engineers Federal Columbia River Power System (FCRPS) projects and payment of interest and amortization costs of Bureau of Reclamation FCRPS projects.

These programs increase in total from approximately $202 million in FY 1983 to almost $256 million in FY 1984. The increases reflect increased generation costs of FCRPS hydroelectric projects and greater interest expense for additional energy conservation and transmission construction program borrowings.

CONCLUSION

This past year or so has been a period of very dramatic change for BPA and others in the region's electric power supply system. We have endeavored to manage the impact of this change on the agency by strengthening our commitment to fiscal integrity and intensifying our application of strategic planning to achieve this goal. We feel this has enabled us to manage our affairs in a businesslike manner and to provide the basic management and organizational abilities to control our destiny while assuring our fiscal integrity and fulfilling the intent of Congress with enactment of the Regional Act. Although BPA, and its partners in meeting the region's energy needs, have suffered economic and financial adversity, our achievements during these troubled, rapidly changing times have established a foundation of fiscal integrity and greater program flexibility. BPA has made strategic choices intended to produce stable power rates in the Pacific Northwest by the middle of the decade. These rate levels will assure the region that its electric rates remain as low as possible and provide for the region's ratepayers the benefits intended by Congress with the enactment of the Regional Act.

Thank you for this opportunity to describe our program situation and budgetary proposals. We appreciate your concern and support, and welcome your questions.

REDUCTION IN PROGRAM COSTS

Chairman HATFIELD. Mr. Johnson, the announcement you made on February 18 to delay the announced, projected wholesale rate increases that were to increase up to, I believe, about 45 percent and to take effect November 1, 1983, were simply unacceptable under existing economic conditions, I believe, was your statement.

You also outlined some ways in which to meet that problem that the rate increase proposal was supposed to correct. One, you indicated there should be some reductions in the original expenses of the BPA.

Would you care at this time to briefly outline some of those areas where you expect cut expenditures to help offset the necessity for increasing the wholesale rates?

Mr. JOHNSON. Yes, Mr. Chairman. I can't give you the exact details, because staff is still working on those at this time, but we in the agency believe that under these circumstances, nothing should go without scrutiny. So within the organization, within our operations of the agency, we are looking at the budgets of every office. I believe that there is the opportunity to save considerable money in that regard, even though we have cut back significantly from previous budget levels.

The area where I do feel we need to make a very careful review within the agency is in the area of transmission construction. I have been watching this since becoming Administrator, and I believe that we are going to be announcing a very significant increase in our wheeling rates. This is not totally a surprise. Nevertheless, it will give the agency an opportunity, right now, to take a bottoms up look and review the transmission expenditures.

I think that some progress has been made.

We have a system, as you know, a grid that has been seen throughout the world as premier.

I think it would be inappropriate to build a Federal system when the Federal network is noncompetitive. I have effectively put a freeze on large parts of construction programing until we have had an opportunity to review it from the bottom up. I expect cost savings from that. In another area, I have challenged the supply system to review all of their budgets, not only for units 3 and 2, but also for unit 1, the one that is presently in suspension.

I expect that they will be able to pass back some savings from that area. I do not contemplate a change in the scheduling, but the way they expend that money; there will be some passback there.

Finally, Steve Hickock, our Assistant Administrator for Conservation, and his staff will go through their program in conservation and find out whether or not we are, in fact, spending those moneys prudently at this time. We are not trying to pass up the opportunity one day to achieve the benefit for conservation and savings, but plan to achieve the savings at such a time as it meets the region's needs. This has been driven by our difficulties at this time, as I mentioned earlier, in marketing power outside the region at reasonable rates, but it is also something that has been discussed in some detail with the Regional Planning Council, and they concur that it is appropriate at this time to make a review of the level of expenditures. They have encouraged us in this effort.

Right now, as you know, we have been looking primarily at residential applications and retrofits. We intend to expand activities significantly in the commercial area and also in industrial areas, so as the need arises, we will be able to move in these areas. We will have staff in place and we will have program and effective policy established, and we will be able to move forward on that aggressively.

SURPLUS POWER FOR INDUSTRIES

Chairman HATFIELD. Moving from general economic conditions to a more specific area of concern. As you know, some of the aluminum plants have drastically reduced operations. There is an economic factor; as I understand, the current cost is about 25 mills, whereas it will cost them about 70 cents if the power rates are increased. We have actually been taken by France and some of the other producing countries who already reduced rates to their industry to sustain it during this particular time of the world market circumstance.

Do you have any plans to market through the direct service customers and the industries some of the surplus power in order to keep the plants working, or if those plants do shut down and thereby increasing your power surplus, will it not have an economic impact upon raising rates, then, for the private, the individual consumer, preference customers, IOU's, and other such users to offset that loss of revenues from the aluminum industry?

Mr. JOHNSON. Yes, Mr. Chairman.

We are reviewing this at the request of the direct service industries. It is something, of course, that our staff has also seen as a potential. What we are looking for are ways to use this nonfirm power which is presently sold in and outside the region for a rate as low as 9 mills to, in some effective way, apply this toward assisting industry. We are also looking at agricultural industries. We do not think we should consider any industries to the exclusion of others, and we want to look at every opportunity to maximize the interests of the region.

It has vast ramifications, frankly, in the near term simply because you can encounter a discrimination problem in some industries which are operating at 100-percent capacity, are taking the energy in at approximately the 24 to 25 mills level, which is the current rate. So, if we were to give other industries a lower level in the industrial rate, then I think we would have to, only in fairness, come back and review the rates we will charge the other users.

Chairman HATFIELD. To all DSI's.

Mr. JOHNSON. To all DSI's and all other customers. They are already saying it should be fair. We are looking at this, and if there is an opportunity, we will seize it.

Chairman HATFIELD. But you have to look at the condition of a patient, too, as well as a prescription. You don't go in and uniformly prescribe the same remedy to every patient when you have economic distress.

I recognize the equity factor and the political factor, but at the same time, I think a lot of people have to recognize that some flexibility on selection of this type of review is going to mean, in the long term, less cost for them, or it is going to mean more cost; isn't that correct?

Mr. JOHNSON. That is correct.

Chairman HATFIELD. You are familiar with the council plan?

Mr. JOHNSON. Yes.

Chairman HATFIELD. Have you looked at the projections on the high side of resource requirements? Are you familiar with that chart?

Mr. JOHNSON. Yes, generally, yes. That is on the high side, up to 5,000 megawatts, yes.

Chairman HATFIELD. That is under these projections and supplies.

Mr. JOHNSON. Yes.

Chairman HATFIELD. Would you read those sources and percentages to me?

Mr. JOHNSON. The one in green is 47 percent of that load growth coming from conservation, 11 percent from hydro, 5 percent cogeneration, 9 percent from combustion and turbine, and 28 percent from coal in the 1990's.

Chairman HATFIELD. Do you think that is a fairly accurate projection?

Mr. JOHNSON. I think that based upon their high growth expectation, which is about 2.7 percent, something that we are not experiencing at the present time——

Chairman HATFIELD. It is 1.6 now.

Mr. JOHNSON. It is less than that. It has been at lower levels during the past few years, but anyway, I think given their assumption for load growth, I don't think that is an unreasonable array of resources.

WPPSS UNITS NOS. 4 AND 5

Chairman HATFIELD. Would you now, then, urge the supply system to sell off the major assets of the terminated plants 4 and 5 in an effort to raise revenues?

Mr. JOHNSON. I am not sure, Senator, that I fully understand that question. Units 4 and 5 are not the business of Bonneville, so I cannot really advise about them.

Chairman HATFIELD. We are talking about the rate structures, about DSI's and all that. There is a relationship, isn't there?

Mr. JOHNSON. It is hard to say that. Units 4 and 5 are owned by the 88 participants, and they don't supply the energy that we control.

Chairman HATFIELD. Let me go back to units 1, 2, and 3, then. Are units 1, 2, and 3 going to be a base system?

Mr. JOHNSON. Units 1, 2, and 3 are already part of the Federal base system, and so they are not included on the chart you just showed me. They are already discounted, if you will, into the present load—excuse me, the present resource mix, and the chart contains units incremental to that.

All of this is incremental to that.

Senator MCCLURE. Let me ask a question so that I understand your answer. Is it correct that the Regional Planning Council, in making these projections, assumes the completion of 1, 2, and 3, and these resource requirements are in addition to those?

Mr. JOHNSON. That is correct. These are incremental to that based upon the load growth that will be placed upon the Administration, and it is building on top of resources already in the Federal system of 30 dams plus our 30 percent of Trojan, the new production reactor at Hanford, 100 percent of supply system projects 1 and 2, and 70 percent of 3.

Chairman HATFIELD. Let me ask, in your professional judgment, is there any reason to proceed with units 4 and 5 at all?

Mr. JOHNSON. I think it would be unwise at this time to proceed with construction of units 4 and 5. Mr. Chairman, that begs a question of whether it should be terminated. I don't think I am qualified to make that final judgment, but certainly in a day of tough judgments, that is a tough decision for the 88 participants who we know do have an interest in those plants.

Chairman HATFIELD. You have no relationship to units 4 and 5 in terms of any financial or fiduciary commitments regarding bail out or any kind of programs for rescue or for survival or resuscitation. [Laughter.]

Senator McClure. Or euthanasia?

Chairman Hatfield. Or euthanasia. [Laughter.]

Mr. Johnson. I think in Eugene you even suggested through a chimney.

None, OK? But——

Chairman Hatfield. Did you use that as a conjunction?

Mr. Johnson. None.

Chairman Hatfield. Then you said "but."

Mr. Johnson. But here is what I think is only appropriate, and that is that the 88 participants, who are public customers of Bonneville, their physical health is important to the physical health of Bonneville.

They are not fully relevant to one another, but they are certainly complementary. There is a linkage there. Also units 4 and 5, as you know, are twins with 1 and 3, so the ultimate result of cost sharing can affect the interests of 1 and 3. But it is only in that regard that I think Bonneville necessarily can observe and remain attentive to the progress and the disposition of those two units.

We have no plans to acquire, to initiate an acquisition, to involve ourselves in any way financially.

Chairman Hatfield. But perhaps try to build a wall between 4 and 5, and units 1 and 2 and 3 to protect those three?

SUPPLY SYSTEM PROJECTS

Mr. Johnson. We are committed to preserving 1, 2, and 3 which are healthy plants. Because of the difficulties in 4 and 5, the possibility of default of the 88 participants and their obligations, or—I say presumed default; obviously we are concerned that that not spill over into the affairs of 1, 2, and 3.

Chairman Hatfield. In observance of that, do you have any plans to build any kind of a barrier, obstacle, or berm?

Mr. Johnson. Well, that has been suggested in light of a possible election by the executive board of the supply system to take out bankruptcy. That is something that would be voluntary on their part. They have made it abundantly clear they have no anticipation of doing that at this time.

However, the financial community is aware of concern that there is a prospect of a change of the board at some future date. In light of that prospect, the change in the board, we are concerned about the division between 4 and 5 and 1, 2, and 3.

Legislation has been sponsored, I understand, in the Washington State Legislature to deal with this.

I think that we should also be concerned about that as a Federal agency.

Chairman Hatfield. What percentage of the increase that took place in 1981 and 1982—I think you had about a 70- or 60-percent increase in 1981 and in 1982 you had about an 80-percent increase.

How much over the 2 years of that increase was attributable to the payment of debt services for plants 1, 2, and 3?

Mr. JOHNSON. I would estimate that at about 30 and 75 percent of the priority firm rate increase for 1981 and 1982, respectively, was due to an increase in debt service on those plants.

Chairman HATFIELD. Of the rate increase?

Mr. JOHNSON. Yes, of the rate increase. These increases were driven by our assumption of debt service on those projects which is a condition of the bond covenants, due and payable as of certain dates. It was the estimated dates that the plants would come on line which determined when obligations would become due. Despite slipped schedules, obligations did become due.

Chairman HATFIELD. What percentage of the increase that you announced that were now withheld beginning in November of this year would be attributable to the same WNPs, 1, 2, and 3?

Mr. JOHNSON. I have not made that calculation, but certainly less, Mr. Chairman.

Chairman HATFIELD. Could you do that for the record for each year?

Mr. JOHNSON. The initial 1983 rate proposal was delayed before the final rate calculations were completed. Consequently, we do not have an estimate of the priority firm rate increases due to supply system cost increases. Also, we have not completed the final cost estimates for the initial 1983 rate proposal to be published in late March. I will provide to you the percentage related to that initial proposal shortly after it is published.

Chairman HATFIELD. Let me yield for a few moments to Senator Huddleston and then to Senator McClure.

ALUMINUM INDUSTRY

Senator HUDDLESTON. Part of your mission is an attempt to enhance the economic development of the area, I take it. You do have a situation there, as you have pointed out in your full statement, of economic ill-health of the aluminum industry and the problems which confront it with the rate structure that you have now.

What can you do, in your judgment, within your authority at the present time, to effect some improvement there?

Mr. JOHNSON. The question is, how can we hold costs down within the agency without jeopardizing the load and maintaining reliable service and make sure that within the law we make the proper allocation of costs to those various classes? There are sensitive problems with the industries, as well as Bonneville customers, throughout the region. I hope we can come up with a rate which will, while not making the industries happy, will not be the cause of their leaving the area.

Senator HUDDLESTON. That is the point. I'm not so anxious to make them happy, but we would sure like to keep them in business if we can. It would be detrimental to your total operation. It would be detrimental to the regular customers.

So, there is a legitimate business reason to try to be as accommodating as it is possible to be. Is there any legislative approach that would be helpful in this situation beyond what you have already done?

Mr. JOHNSON. Senator, that is a good question. It has been asked by others. I do not have anything that we could suggest at this time or even speculate on something the Congress might do.

I am keenly aware of the interest that Congress has in the healthy aluminum industry in the Pacific Northwest, not just for the Pacific Northwest, but for the country. As we move forward and see what is going to be driven by law, then I will be in communication.

AVERAGE RATES FOR CUSTOMER GROUPS

Senator HUDDLESTON. The effect will be not only on the Northwest, because some of the branches of the same industry are located, coincidentally, in Kentucky. It might very well have an adverse effect if they are not able to compete and to operate out there.

What is the difference in the average rate for the general customers and the customers such as the aluminum industry?

Mr. JOHNSON. The rates average right now, the preference or priority firm rate for public customers, is about 18.5 mills per kilowatt-hour. This is the current rate that is in effect. At the present time, we are at about 24 to 25 mills for our DSI customers. We have roughly a 30-mill rate for new loads that would be placed on the Administrator by private utilities. That gives you a comparison range for our customers. The average retail rate charged by BPA's public agency customers in the Pacific Northwest is 27.3 mills per kilowatt-hour.

Senator HUDDLESTON. Under that formula what is likely to happen if it is not adjusted?

Mr. JOHNSON. The one that is at 18.5 mills, by early analysis, initially appeared to be moving as rapidly as 45 percent upward. Last Friday we put a halt to our announcement, and we are reviewing our cost figures that we have already supplied. There is also an impact on the current DSI rate at 24 to 25 mills. I cannot tell you what that impact would be because we have not made our final analyses. It would be less than that amount.

Senator HUDDLESTON. So it would be less?

Mr. JOHNSON. It would not have been in the range of anywhere near 45 percent. It would have been something less than that. We did not make an analysis of our increase of what we call the new loads that will be placed on us by private utilities, but there is an interesting phenomenon at the present time. The worldwide industry for aluminum is in terrible shape. Even with our current rates for the Northwest DSI customers, I am told they would be losing money. We are not just taking the word of our customers and relying on that. We have made our own independent analysis. Our rates have come up from as low as 4 to 6 mills within the last 3 or 4 years. This has been driven largely by the Regional Power Act, whereby the industries in 20-year contracts took on what we call an exchange, which is the difference between the Bonneville rate and the average system rate so that particularly the residential and farm customers get a break. That is what has driven the rate up for the industries.

It is not a judgment call the Administrator can make. It is set at the difference between our rate and that of investor-owned utilities.

Senator HUDDLESTON. Does that account for the heavy increase?

Mr. JOHNSON. That is where it came from exactly.

Senator HUDDLESTON. Will it take legislative action to correct it?

Mr. JOHNSON. I think so. It's material. I think the limitations that the Administrator has would call for that.

Chairman HATFIELD. Would the Senator yield? Northwest industry is strapped. The point is, our projections for the increased energy usage, including the offset for an increase in the rate for the DSI's was in return for an extension of a 20-year contract. They did not, at that time, commit themselves to other than interruptible power. So that stability of energy over the period was worth the offset of increased rates.

Senator HUDDLESTON. That is almost an analogy of the take-or-pay contracts in the gas field. When you have got excess production capacity, a good business person will bring rates down so we can keep everybody going.

Chairman HATFIELD. Supply and demand. The seller has to come down if there is a big supply.

Senator HUDDLESTON. It seems to me we ought to do that.

POWER SALES OUTSIDE THE NORTHWEST

Senator MCCLURE. I would like to go into that if you would yield.

I think you pointed out in your statement at one point the great increase in the amount of power that has been sold outside of the region. You indicated in your statement that that is as low as 9 mills. The result is that this downturn in consumption in the Northwest, which has created a surplus, that the savings of that surplus are exported out of the region and the people that are within the region are paying the increased costs because of the downturn.

I am right at the point, very frankly, of either amending PURPA to require the California utilities to take that power at avoided costs as we do for all cogenerators, or at no less than the cost that is required of other people in the Northwest.

I don't see any reason why this change in relationship between supply and demand should benefit only the people outside the region.

That is kind of a perversion of the existing circumstance, it seems to me.

Let me ask this question. I assume that all of that load that has been exported outside of the region has been sold to the utilities that used it instead of generating by other means?

Mr. JOHNSON. I would assume so. It is not firm energy, so they probably displaced their own units, probably petroleum units.

Senator MCCLURE. Petroleum or natural gas, because a lot of the peaking power is natural gas.

Mr. JOHNSON. Yes.

COSTS OF POWER

Senator MCCLURE. So they are getting it at dump rates in substitution for their highest costs. What if we were to look at their highest costs; what would their highest costs be within the areas they are buying?

Mr. Johnson. As high as 40, 45 mills, but with the declining price of petroleum, it would be something less than that now.

Senator McClure. So if you say it is only 40 mills instead of 45, or only 35 mills instead of 40 mills, and they are getting it for 9, but for every kilowatt-hour, their consumers within their region are getting a 26-mill subsidy out of the Northwest.

Senator Huddleston. Maybe the industries can buy it back if they can afford it.

Mr. Johnson. Senator, this is under very careful analysis at the present time. Primarily we are under the buyer's market situation. The Southwest utilities are obviously doing what they think is in the best interests for themselves.

Senator McClure. I understand that. I don't blame them. I just don't want to keep it going.

Mr. Johnson. We are taking a hard look at it. That is not only in the interests of the Northwest ratepayers, but in the interests of the Southwest as well. Such strain, as you described, will not continue without a response one way or the other.

Chairman Hatfield. What are our options?

Senator McClure. If we cut them off, they go back to burning petroleum and natural gas; is that correct?

Chairman Hatfield. At a lower rate with petroleum than what they were first paying.

Senator McClure. Yes, it would be some 35 mills, probably, at the lowest.

I am not angry.

Chairman Hatfield. As a substitute for 9 mills.

Senator McClure. Yes. I'm not angry with them, it's just that the market change has been so great.

Chairman Hatfield. I don't know whether free enterprise has run, Mr. Johnson.

Mr. Johnson. Not exactly, but a strange phenomenon has developed in the last couple of weeks because of lower loads on a broad horizon. Even at the lower rate, the intertie is not loaded to full capacity on certain dates. The reason is because it is a good water year in the Southwest and they are on take-or-pay contracts for gas. They are also in a good situation as to their hydro power. The intertie, if you can believe it, is not fully loaded at the 9-mill rate.

I just wish we had an intertie to the east coast. [Laughter.]

Chairman Hatfield. Will you yield for a moment?

CALIFORNIA POWER COSTS

What is their lowest mill cost in the southern California area?

Mr. Johnson. Of their own?

Chairman Hatfield. Yes, within their own system.

Mr. Johnson. I will——

Chairman Hatfield. They are paying 35 mills, did you say, for gas?

Senator McClure. He said 40 to 45, but it is lower than that now.

Chairman HATFIELD. What is their hydro?

Mr. JOHNSON. I think the rates in California are obviously higher than they are in the Pacific Northwest. I would say they range from 50 mills to approaching 100 mills.

Chairman HATFIELD. In other words, this 9 mills would still be the cheapest part of their supply?

Mr. JOHNSON. No question about it, unless, at the present time, they have their own resources with sunk costs, dams built years ago, like we have in the Northwest.

Chairman HATFIELD. But not outside of hydro. They would still have to buy and purchase oil and gas, so if that is at 35 or 40 or whatever mills, why wouldn't it be to their economic advantage to buy as much 9-mill power for their mix, with their hydro?

Senator McCLURE. They also get it from other Federal-based systems, don't they?

Mr. JOHNSON. And also from other utility systems outside the region, from New Mexico and Arizona, coal is coming in at 20 mills, I am told.

Chairman HATFIELD. Whatever price, if 9 is still the lowest, I cannot understand why they would not gobble up all the 9-mill power they can get to the exclusion or the reduction of the other mixed resources.

Mr. JOHNSON. It could be low loads; in other words, low demand.

Senator McCLURE. I think they probably have, except for avoided costs in the owner-based systems.

Chairman HATFIELD. Mr. McPhail, maybe you would like to comment on this, too, since you are a part of the picture.

Mr. McPHAIL. Of course. A large company like the Pacific Gas & Electric Co. of San Francisco has a blend of fuel supplies. They have a hydro system, oil-fired units, and gas-burning peaking units. They have access to an intertie to bring in surpluses. When you blend all of that together, their wholesale rates are around 40 mills per kilowatt-hour.

Senator McClure. But whatever incremental supply they get is in substitution for their highest cost.

Mr. McPHAIL. Yes.

Senator McCLURE. It isn't really in substitution for their blended rate.

Chairman HATFIELD. That is right. That is what they average.

Mr. McPHAIL. Many of them have take-or-pay contracts on oil, so it forces them to burn oil which reduces the need for surplus energy from the Pacific Northwest.

Senator McCLURE. We might give them a little relief there.

Chairman HATFIELD. Why can't they cut it back?

Mr. McPHAIL. It is take-or-pay on some of those contracts. If they don't burn it, they lose money.

Senator HUDDLESTON. We are referring now to a condition that existed just 2 years ago.

Mr. JOHNSON. That is right.

Senator HUDDLESTON. And the cry was to get energy at any cost under these contracts.

REPAYMENT STATUS

Senator McClure. Mr. Chairman, could I ask two or three questions?

On page 4 of your statement, you mentioned that you expect revenues and you expect to establish a rate base to give you the revenues that will be necessary to pay all of the debt service including the accrued deferred interest by 1985. You identify that accrued deferred interest at $226 million. Am I correct?

Mr. Johnson. A year ago, Senator, at this time, it was estimated that by the end of fiscal year 1982 we would be $226 million in arrears. Because of cost cutting and other factors, it was only $152 million. The $226 million estimate was made prior to the end of the last fiscal year.

Senator McClure. So, there is a remaining $152 million.

Mr. Johnson. Plus an additional $316 million amortization derived from our repayment study.

Senator McClure. Have you given thought to asking for the opportunity to avoid that accelerated payment? I'm not suggesting that it not be repaid, but at a time of exceptional economic distress, doesn't it make some sense, maybe, to say, "Now is not the time to double up our payments"?

Mr. Johnson. I made what I refer to as a business call last year saying that we would repay that deferral over a 3-year period. I thought that it was prudent to call for a 3-year catchup in our payments, in addition to keeping square with the regular amortization. We still hold on that position. I think that's a responsibility that the region should bear.

Senator McClure. There isn't any doubt in my mind that the region must bear that repayment cost, but I don't want them down on their knees groping and trying to get up.

Can they stand another $75 million per year?

Mr. Johnson. I have not formally asked for relief from that catchup.

Senator Huddleston. Would you object if somebody asked for it for you? [Laughter.]

Mr. Johnson. I think that would have to be a call that would be made by the Congress and by the administration, and I would expect it to be made.

FISH AND WILDLIFE PROGRAM

Senator McClure. On page 14 you indicate that part of the increased costs are new and expanded programs directly related to the Regional Power Act, notably resource acquisition, fish and wildlife support, and the BPA's residential energy exchange.

On page 18, you identify separately the fish and wildlife program as presented to you by the Northwest Council. Is that all there is? In other words, of this increase identified on page 14, the only portion which is fish and wildlife addition is that which you have identified on page 18?

Mr. Johnson. I believe so. Let me just see if I can get my hands on that. All I have is my summarized statement here.

What is the amount in there, Senator, and I can tell you.

Senator McClure. At the bottom of page 14, it says:

> A substantial part of the $449 million increase in BPA's budget from fiscal year 1983 to fiscal year 1984 provides for new and expanded programs directly related to the Regional Act.

Then the rest of the language that I read earlier.

On page 18, at the bottom of the page, it says:

> Fiscal year 1984's requirement of $163 million for the operation and maintenance program is $34 million above the fiscal year 1983 funding level primarily due to increased fish and wildlife costs as BPA implements the regional council's fish program.

Mr. JOHNSON. I think that would be directly related to the fish program requirements of the act..

Senator MCCLURE. Do you intend to implement the water budget proposed by the Regional Planning Council in your next operational year?

Mr. JOHNSON. It will be in our 1984 rate year. In fiscal year 1983 we are attempting to use the surplus power that we have to meet as much as we can of the recommendations for the fish flush.

WATER BUDGET

Senator MCCLURE. But is this $34 million wholly associated with that, or does it include in it the costs of installing fish and wildlife mitigation measures in addition to the water budget?

Mr. JOHNSON. The costs of the water budget are not reflected in the $34 million figure. The council made recommendations which reflect roughly a $3 million capital expenditure program in fiscal 1984 which we feel is appropriate. That would be amortized over time.

Senator MCCLURE. Is it included in the $34 million figure?

Mr. JOHNSON. I believe it is included in that number. Approximately $26 million of that number has been recommended for fish mitigation programs, including capital expenditures.

So there is some $26 million in the rate case and in this budget to carry out the recommendations for fish-related research and development.

Senator MCCLURE. I am sure that you are aware that the so-called fish flush is a very controversial suggestion.

Mr. JOHNSON. There are a number of controversial points in the council's program, but it is my belief that the water budget is one of the least controversial.

Senator MCCLURE. You are hearing from different people than I am hearing from. [Laughter.]

How are you going to get enough water to flush the fish unless you interfere with the operating licenses of vital power company dams in Hell Canyon, just for starters?

Mr. JOHNSON. There is some 78,000-foot-per-second requirements on the Snake River, a portion of which will come from Dworshak, whereas the rest will come from the Idaho Power Co. Brownlee dam.

Senator MCCLURE. Have you talked to the people who fish down on those streams and talk about the increased river flow that is necessary to get that fish flush?

Mr. JOHNSON. I have not spoken to them personally. But I have advised them, Senator, that in our rate process, there will be the opportunity to go on the record with their concerns about the recommendations in the council's program.

It is a marvelous opportunity for all parties to express both pros and cons before I make a decision ultimately on the record.

Senator McClure. You indicated earlier that you are expecting to make certain savings in general operations but you think you must analyze everything that you have done.

Mr. Johnson. That is correct.

NORTHWEST COUNCIL FISH PLAN

Senator McClure. Then you take the fish and wildlife mitigation proposal by the Northwest Council and take it lock, stock, and barrel without question.

Mr. Johnson. I think the audit or the review of that will be the direct result of our very open and public process in review of rates.

I have not taken unilaterally the challenge to look at those rates. I see that as outside what I call the utility affairs of Bonneville. Indeed, it is a different program under the Regional Power Act that is——

Senator McClure. Fish and Wildlife mitigation programs suggested by the council is only that, is it not? It is a suggestion?

Mr. Johnson. Well, it is their program, and I am to implement it to the highest degree practicable.

Senator McClure. Is it practicable?

Mr. Johnson. Well, we have reviewed—staff has reviewed the recommendations of the council for the water budget through the research and development expenditures in the $300 million capital program.

We at this time don't find them unreasonable on their surface. We have challenged them to do a thorough evaluation and we intend, through the rate process, to encourage persons to lay out on the record their feelings on that subject which will help the Administrator and Bonneville make a final judgment.

Senator McClure. What is your estimate of the power loss in the water budget stated in megawatts?

Mr. Johnson. Around 550 megawatts is the estimated loss of firm power.

Senator McClure. Is that your estimate or theirs?

Mr. Johnson. That is one that I think our people, working with the Corps of Engineers and staff, came up with.

Senator McClure. Are you aware of other estimates as high as 3,000 megawatts?

Mr. Johnson. I think, Senator, that might have been the estimate of what would have resulted had the original request of the Indian nations been followed. They wanted us to return river operations to a natural state. I think that would have, by analysis, resulted in an estimated loss of 3,000 megawatts. But the actual water budget requested and the flows that they had prescribed we calculate to result in a loss of about 550 megawatts.

BPA AND COUNCIL FISH RESPONSIBILITIES

Senator McClure. Two things, and then that is the only question I will have with respect to Bonneville.

One is that the act requires, I believe, that the Northwest Council take fish mitigation activities prospectively.

As I read their fish and game plan, it is retrospectively for correction of past actions, which I think is not an accurate reading of the bill.

Second, I believe that Bonneville has an independent responsibility to verify the plans. I do not think Bonneville has a responsibility to accept from the Northwest Council directions anymore than any other Federal or private or State agency has. Do you read the act to indicate that you must do what they suggest?

Mr. JOHNSON. The wording is that we are to implement the programs to the highest degree practicable.

We have worked with them somewhat, less on the fisheries program than we have on the energy plan in its development. We do believe that the Administrator stands in shoes not dissimilar to those of the council because they are instructed to protect and mitigate and enhance fish and resources. So, too, are we, but I, once again, have made it a policy not to become the ultimate and consummate expert on fish or fishery resource interests in the area.

We have a small staff—I call it a lead group of experts—capable, hopefully, of evaluating issues evaluated by fishery, Indian tribes as well as the council. The testimony delivered by those who would be adversaries to the program has been presented to inform the Administrator, and that will become part of the record upon which I make my final call, because I must make my call on the record.

Senator MCCLURE. You make your call on the record, but you are making an assumption in the rate case.

Mr. JOHNSON. Only in the preliminary numbers. The preliminary numbers moving forward are those substantially that have been recommended by the council, but what finally is the number will be a judgment call based on the record by the Administrator.

Senator MCCLURE. But the rate case will be submitted in the next 30 days?

Mr. JOHNSON. Correct.

Senator MCCLURE. Why shouldn't you make a different assumption with respect to the rate case?

What you are having are the recommendations of the council drive your rate submission, even before you have decided whether they're right?

Mr. JOHNSON. As I say, we have reviewed the program and find it not unreasonable given the level of our staffing and experience and expertise in this area.

Senator MCCLURE. You have as much staff and expertise and a great deal more experience than the council has. It has been in being for a year and a half.

Mr. JOHNSON. They have staff, but they also have consultants that they have been relying upon more than we have.

NORTHWEST COUNCIL PLAN RATE IMPACT

Senator McCLURE. I don't mean to fight with the Council at this point on their plan, but I think you are giving the plan greater credibility to the rate submission than that plan is entitled to either under the law or as a practical matter. That drives you to a different rate submission which has a great effect upon the Northwest. It would seem to me that you would be better off to assume that that will be in your next rate submission rather than in this one.

It is very unlikely, in my judgment, that the water budget implementation will occur within the period covered by this rate submission, as an example.

Mr. JOHNSON. This rate submission covers through July 1, 1985, so it does go, I think, into that operating year.

Senator McCLURE. But you can revise the rates for changes that occur during that period of time, can you not?

Mr. JOHNSON. There is very little, if any, opportunity to reopen the rates once they're published; precise requirements were in the section of the Regional Power Act. I am told that I have very limited authority, if any, to reopen a rate case once it is published, until such time as we go through the formal process.

Senator HUDDLESTON. No further questions.

PREPARED QUESTIONS FOR THE RECORD

Senator McCLURE [presiding]. Senator Hatfield and I have additional questions which I will place in the record at this time.

Mr. Secretary, who is next?

Mr. TRIBBLE. Bob, do you want to go next?

Senator McCLURE. The last shall be first.

[The questions and answers follow:]

QUESTIONS SUBMITTED BY SENATOR HATFIELD

Rate Increases

Question: You "challenged the Washington Public Power Supply System (WPPSS) to reduce its cash requirements between now and 1985 on all net-billed projects." In your view, how should the WPPSS board and management reduce spending?

Answer: As part of its 1984 planning and budgeting process, Supply System management will look at ways to defer or reduce construction costs and operating expenses. This process has only recently begun. The Managing Director's transmittal of budget instructions indicated that managers are to look for ways to accomplish work using less time and money. Areas which could be examined include the sequence of construction work at the projects, the management plan for the construction delay on Project 1, and the timing of costs in operating budgets for Project 2.

As you are aware, BPA oversight staff will work very closely with Supply System staff for the next several months on its 1984 budget process. We will have an opportunity to participate in meetings and work sessions during which the budgets will be developed.

Question: What is your projection of future rate increases after July 1, 1985?

Answer: If the effects of inflation are removed, our analyses suggest that the increase in the priority firm rate for the period beginning October 1, 1985 and ending September 30, 1990, is estimated to be 14 percent. This is an average annual growth rate of 3.4 percent. This estimate is based on the assumptions in and results from BPA's July 1982 long-term forecast of electricity consumption in the Pacific Northwest.

Load-Resource Forecast

Question: I understand that your first regional load-resource forecast issued in July 1982 showed an annual load growth of 1.6 percent until the year 2000.

When do you anticipate a revision of this load forecast?

Answer: We are working right now to update our economic and demographic projections, as well as make minor modifications and improvements to the forecasting model. We expect to complete a new 20-year regional load forecast by early April of this year.

Question: How much funding and staff effort are provided for this activity in FY 83 and FY 84?

Answer: The equivalent of approximately 15 staff years of effort are involved in developing long-term forecasts of the region's economy and associated energy consumption levels. The budget for that staff, in addition to various contract research efforts in the area of long-run forecasts, is $1.7 million for both FY 1983 and FY 1984. About half of that amount is devoted to load research and primary data collection for energy-related surveys.

Question: How do you coordinate this effort with the forecasting process and resources of the NW Planning Council?

Answer: An exemplary level of cooperation has been established between the forecasting staffs at the Council and BPA. Both agencies rely on very similar forecasting models in the residential and commercial sectors, and therefore much data, information, and experience have been shared. While both the Council and BPA understandably wish to maintain some degree of independence in this important area, there are a number of areas where both staffs have been able to benefit from cooperative research and information exchange.

Energy Plan

Question: The NW Planning Council has drafted their 20-year energy plan. Mr. Administrator, have you reviewed this plan and do you have any reaction to it?

Answer: We have reviewed the Draft Plan and are preparing testimony to present to the Council at the hearing in Coeur d'Alene, Idaho, on March 14, 1983. We are also preparing detailed written comments on the Draft Plan which we intend to submit to the Council by March 21.

The Council has emphasized that the Draft is not a final plan in disguise, but rather a tentative document for review and comment, subject to revision. We find that the areas of agreement between BPA and the Council, as manifested by the Draft Plan, far exceed the areas of disagreement. Most of the Council's technical analyses have been independently corroborated by BPA. There has been a convergence of Council and BPA views, buttressed by analyses of our respective staffs, on such matters as load forecasts, conservation assessments, Fish and Wildlife Program implementation, and costs and availabilities of resources.

BPA anticipates no insoluble problems or irresolvable difficulties in effective implementation of those portions of the Council's Plan for which BPA will be responsible.

Marketing

Question: The current rate charged direct-service customers in the Region, as I understand it, is 24.5 mills. BPA is contemplating further rate increases this year, in order to meet budgetary requirements. What impact on the direct-service customers do you contemplate as a result of further rate increases?

Answer: In developing the rates which impact the direct-service customers, BPA projects its loads considering both the load response to changes in BPA's rates and changes in the world price of aluminum. Currently, both the world demand and price for aluminum are depressed. Consequently, the impact of BPA's next rate increase on the direct-service industrial customers is very dependent on the recovery of the aluminum market during the rate period.

Question: BPA is currently trying to market surplus power out of the region, but is having a difficult time marketing firm power, as I understand it. Would you comment on this please?

Answer: Yes, BPA has had difficulty marketing firm surpluses outside the region on a short-term basis. Several factors account for the current situation. First, the Columbia River hydrosystem currently has above average water conditions, combined with reduced Northwest loads. As a result, the region has had an abundance of nonfirm energy plus a surplus of firm energy. Given these conditions, Southwest utilities perceive it is to their advantage to wait and purchase power at BPA's nonfirm rate rather than the significantly higher firm power rate.

A second factor is the declining oil price which has reduced the differential between BPA's firm power rate and the price to run oil-fired generation in the Southwest. The decline in this differential reduces the cost of their risk if they have to run oil-fired generation.

A third factor is the availability of coal-fired generation from Arizona and New Mexico at prices below the BPA firm power rate.

Other factors include P.L. 88-552 which limits BPA's ability to market firm power outside the region, existing legal and contractual arrangements which govern the use of the Intertie and the accommodation of competing energy, and the capacity of the Intertie to accommodate the amount of power available.

A long-term firm sale appears more promising and discussions are now underway with Southwest utilities. A sale to the Southwest of Northwest firm surplus resources for a 15- to 20-year period would allow Southwest utilities to forego large capital investments, which they view as a benefit to them.

Question: BPA expects even more surplus this spring, and is spilling water at this time, because of a lack of markets for this surplus power. What impact is this action having on anticipated and realized revenues?

Answer: The impact is that our FY 1983 revenues will be below our initial projection. We had initially estimated that during FY 1983 we would sell about $342 million of surplus firm power, surplus energy, and nonfirm energy; we currently estimate that we will realize only $322 million from these sales. I would like to submit a table for the record which presents this in detail.

Operating Revenues from Surplus Firm Power and
Energy, and Nonfirm Energy for FY 1983
(in millions of dollars)

	Original Revenue Estimate	Subsequent Estimate
Surplus Firm	169.0	0
Surplus Energy	0	59.1
Nonfirm Energy	173.5	263.1
Total	342.5	322.2

Because BPA has additional energy to sell, we are analyzing various options to make it available to offset this revenue shortfall.

WPPSS

Question: Construction on WPPSS 1 was deferred up to 5 years last May, with about $2 billion spent and the plant over 50 percent complete. Work continues on WPPSS 2 which should be completed this year. WPPSS 3, in which BPA has a 70 percent interest, is about 70 percent complete with about $960 million of work remaining.

Please outline the obstacles, including lawsuits, which must be overcome to keep WPPSS 3 on schedule for a 1986 startup.

Answer: To maintain the existing schedule for the startup of Project 3, it is necessary to market Supply System bonds before the Supply System's existing capital has been exhausted. We have been advised by the core group of underwriters that there are three current obstacles to obtaining market access. The first is the pending appeal to the U.S. Supreme Court of the Initiative 394 issue. The second is the prospect of a commingling of funds among Projects 1 through 5 in the event the Supply System should elect to file a petition under Chapter 9 of the Bankruptcy Act. The third is the disposition of pending litigation questioning the validity of the Net-Billing Agreements. This litigation was filed by the Springfield Utility Board in the U.S. District Court for the District of Oregon.

Question: Does the Supply System have enough funding to continue the current schedule for WPPSS 3? In your view, can they go to the bond market for money to continue this net-billed project?

Answer: The Supply System currently has sufficient funds on hand to continue full construction efforts and to make commitments on Project 3 through May 1983. The Supply System Executive Board is expected to take action soon, however, to reduce near-term cash requirements and to extend available cash.

The investment bankers who handle Supply System financing are of the opinion that the Supply System cannot go to the bond market unless the three key issues I have just discussed are resolved. We hope these issues will be resolved by spring or summer of this year. That would permit continued financing of Project 3 at that time.

Question: If the plant is delayed, what is the best option to slow construction in your opinion and what is the impact of this type of delay?

Answer: The best option would be to reduce the pace of construction because that would best preserve funds for resuming construction, retain the critical work force, minimize adverse impacts on the economy of the local area, and provide flexibility for resuming full-scale construction as quickly as possible when additional financing is available.

Such a project slowdown would have both positive and negative effects. On the positive side, cash for continued construction would be preserved; there would be minimum economic repercussions on the area, with minimum loss of key personnel. Also, it would be possible to readily return to full-scale work and make up any lost time. On the negative side, any construction slowdown would jeopardize scheduled commercial operation, adversely impact morale and productivity of Project and Supply System personnel, and increase the cost to complete the Project.

Question: Will there be a market for the power produced from WPPSS 3 in 1986?

Answer: BPA's current regional load forecast, which includes Project 3 as a resource in 1986, shows surpluses until the early 1990's. While this might indicate that Project 3 could be delayed from a resource-need standpoint, several factors would argue against that conclusion. First, delaying completion of Project 3 for several years would significantly increase the costs of a resource that is 70 percent complete. Second, load growth could be higher than currently forecasted, or the level of currently planned resources could be lower than forecasted, resulting in a need for the Project close to its current schedule. Finally, it is less expensive for the region to complete the Project, given its current costs to complete, and enter into a long-term sale to the Southwest for firm resources. The availability of Project 3 in 1986 would enhance the possibility of that sale.

Question: Efforts were underway by private parties to sell power from WPPSS 4 and 5 to the Southwest -- are there similar efforts by BPA or anyone else to market surplus power to the Southwest?

Answer: Northwest entities have formed a marketing group which includes BPA, utilities, direct service industries, and the Regional Council, with the objective of exploring a system sale of surplus firm power to the Southwest on a long-term basis of 15 to 20 years. The group has recently had discussions with utilities in the Southwest who might have an interest in a long-term firm purchase. Amounts of power, length of a sale, and price have all been discussed with Southwest utilities. The next step in the process is to determine the amount of power Southwest utilities have an interest in purchasing from the Northwest. Responses from Southwest utilities are now being received. Following an expression of that interest, more detailed discussions will begin. The objective is to have a long-term sale in place by July 1984 if both regions agree that such a transaction is mutually beneficial in the long run.

Depending on the amount of power that might be sold to the Southwest through a system sale, a resource such as Supply System Projects 4 and 5 may be necessary to assure that the region has sufficient resources to make such a sale.

Question: There are many conflicting accounts in the media about the amount of money available to the supply system to cover interest payments on July 1 and beyond for WPPSS 4 and 5. What is your view?

Answer: It is my understanding that the Bond Fund Trustees have adequate funds, including the reserve account, to meet the interest payment due on Project 4 and 5 bonds on July 1, 1983. Further, I understand that such funds will cover only part of the interest payment due January 1, 1984, without the infusion of additional capital. There appears to be some uncertainty as to whether contractor claims could reach these funds and thereby upset the interest payments due on July 1, 1983.

Cost Reductions

Question: During the hearings on the FY 83 budget, you mentioned that program managers had identified opportunities to reduce expenditures and increase revenues. Did you implement these plans and what is the impact in FY 83 and FY 84? Please provide a list of the specific reductions for the record.

Answer: During FY 1982 BPA's program managers identified a substantial number of reductions in costs between the time the last budget was presented to the Congress and the presentation of this budget. Even after allowing for essential increases that occurred in other programs, the total reductions identified exceeded $300 million. We were able to make these reductions by finding new or innovative ways to carry out our program responsibilities and by not undertaking an aggressive resource acquisitions program. The latter reductions occurred in recognition that regional loads were falling below our initial projections.

I appreciate the opportunity to furnish a comparison for the record:

Comparison of Budgeted Obligations--FY 1983
(in thousands of dollars)

Budget Program	1983 Column in the 1983 Document	1983 Column in the 1984 Document
Resource Planning, Acquisition & Oversight (including Purchasing Power & Wheeling)	1,786,150	1,373,700
Conservation	285,000	253,500
System Planning & Construction	202,000	218,700
Operation & Maintenance	109,450	129,000
Reimbursable	1/	88,500
Interest	145,900	109,900
Associated Project Costs	85,100	91,900
Total	2,613,600	2,265,200

1/ Not separately identified in FY 83.

These reductions also had an impact on the FY 1984 program levels. As you know, we are reanalyzing the FY 1984 program levels and when our analysis is finalized, I will provide the Committee with the new program levels.

Question: On February 18, you proposed to "further cut internal BPA operating costs more than $15 million in the upcoming rate period." What are your plans for these reductions?

Answer: I have asked BPA's program managers to identify reductions in both FY 1983 and FY 1984. I plan to implement the FY 1983 reductions immediately, and I have postponed by a month the announcement of our preliminary rate case to accommodate the reductions for FY 1984.

Question: How do these reductions differ from the proposal in FY 1983?

Answer: These reductions have not been finalized, and as a result I do not want to speculate on their impact for FY 1983. After all the reductions have been identified and their impacts assessed, I will report their impact to this Committee.

Question: Please explain the need for $1.25 billion in additional borrowing authority for transmission system planning and construction.

Answer: BPA requires an increase in borrowing authority under the 1974 Federal Columbia River Transmission System Act to fund ongoing construction, system additions and replacements, and capital investments for fish facilities from this fund source as authorized by the Regional Act. This action is necessary first, to insure that BPA, on behalf of its electric ratepayers, meets its electric utility responsibilies by continuing to fund multiyear electric transmission construction activities, and second, to finance the construction of fisheries facilities. Since the original $1.25 billion borrowing authority which was authorized in the 1974 Act will be exhausted, it is necessary to obtain authorizing language amending the original Act to increase the borrowing limitation by another $1.25 billion.

If BPA's borrowing authority is not increased, BPA has only three options for carrying out its programs. First, we could seek supplemental appropriations from Congress to fund construction, renewable resource acquisition, and capital investments for fish facilities. Second, we could fund construction from available revenues. This would require a substantial increase in rates. Funding of these activities would have to compete with established priorities, for instance, net-billed Supply System costs, for available revenues. Or third, we could reduce our construction program and abandon plans to use this borrowing for any future renewable resource acquisitions or fish and wildlife mitigation activities.

It is therefore imperative that the authorizing legislation be enacted as early as possible, but not later than the enactment of a FY 1984 Energy and Water Development Appropriations Act or a continuing resolution making the additional borrowing authority available.

Question: Provide the Committee with a breakdown of the funding level for each of the planning, design, and construction activities. Also, provide a detailed distribution of the staff allocated for these activities in FY 80, FY 81, FY 82, FY 83 and FY 84. In addition, please list major construction projects over the 5-year period with funding levels for each.

Answer: I will provide this information for the record.

Funding levels for major projects, activities, and staff are detailed on Tables A to D for FY 1980-84. Table A reports total obligations each fiscal year for each budget item. Obligations shown on Tables B, C, and D are BPA's direct activity costs. They exclude obligations for land acquisition, material procurement, contract construction, and overhead costs, all of which, however, are included in the total budget item obligations of Table A. Likewise, staff allocations are also only those directly charged to BPA's planning, design, and construction activities.

The sum of project totals on Table A is not identical to the annual program budget total because budget items are rounded.

Table A - 5-Year Project Funding Levels

Major Project (Budget Item)		Obligations (in thousands of dollars)				
		FY 1980	FY 1981	FY 1982	FY 1983	FY 1984
100	D.C. Intertie Uprating	0	153	34,088	4,318	1,235
101	Western Montana	19,282	42,951	45,897	68,968	48,081
109	Southwest Oregon	0	38,966	12,214	4,276	0
112	Industrial Services	0	0	0	0	1,171
113	Allston-Portland	0	0	0	118	1,290
114	Fairview-Bandon-Rogue	0	3,833	443	4,552	80
115	Grand Coulee-Raver	0	3,823	325	1,170	0
116	Badger Canyon-Grandview	0	0	137	1,215	11,732
119	Flathead Valley	0	0	0	1,137	11,388
120	Bend	0	0	166	3,147	2,597
121	Grays Harbor	0	0	22	29	259
123	Olympic Peninsula	0	0	0	0	251
124	Bellingham	0	0	0	47	2,939
125	Big Eddy-Celilo	0	0	0	4,128	1,381
126	Longview	0	0	0	0	12
129	North Idaho	0	0	0	0	40
130	Boundary-Colville Valley	0	0	0	11,537	13,544
132	Port Angeles	0	0	0	0	85
133	Centralia	0	0	0	0	2,260
134	East Lewis County	0	0	0	0	750
135	Fall River Lower Valley	0	0	0	0	890
136	Santiam-Chemawa	0	0	0	0	325
150	System Reactive Facilities	3,754	1,633	1,380	2,382	3,049
183	Ashe-Willamette Valley	20,425	6,550	2,457	1,551	60
185	Hot Springs-Bell	418	224	397	1,800	31,820
188	WNP #3 Integration	2,781	7,891	8,566	2,873	752
194	WNP #1 Integration	736	12	91	0	0
197	Northern Idaho	10,237	129	6,404	6,265	4,926
227	San Juan Islands	69	5,061	1,375	202	0

Table A - 5-Year Project Funding Levels (continued)

Major Project (Budget Item)	Obligations (in thousands of dollars)				
	FY 1980	FY 1981	FY 1982	FY 1983	FY 1984
312 Albany	0	0	0	56	747
315 Clark County	0	0	0	1,350	855
316 Salem-Tillamook	0	0	0	1,243	2,427
605 Okanogan	8,910	10,013	4,844	865	12
612 Trentwood	0	0	1,323	2	10
613 Bell-Half Moon	0	19	1,518	49	0
614 Okanogan - Phase II	0	0	0	0	1,294
717 Goshen-Swan Valley	0	877	465	351	150
718 Surprise Valley	0	0	0	9,673	1,374
721 Midway-Grandview	0	0	0	60	1,359
770 Customer Services	3,053	3,481	8,332	15,462	6,950
810 General Structure and Improvements	2,040	2,136	9,228	11,252	5,138
820 Power System Control	5,561	3,350	9,423	14,488	18,670
830 Tools and Equipment	5,034	6,538	9,250	18,644	17,785
840 Preliminary Engineering	8,967	8,482	9,377	11,050	10,839
871 Transformer Additions	5,256	3,558	8,955	5,751	5,761
880 Miscellaneous Replacements and Capital Additions	5,849	4,537	6,080	6,976	5,050
Other	14,975	16,934	19,119	503	0
Total	106,901	154,217	201,976	217,490	219,338

Table B - 5-Year Planning Activity Funding Level

Major Project (Budget Item)		FY 1980	Obligations (in thousands of dollars) FY 1981	FY 1982	FY 1983	FY 1984
100	D.C. Intertie Uprating	0	300	1,626	282	82
101	Western Montana	2,000	2,500	2,267	4,511	3,146
112	Industrial Services	0	0	0	0	76
113	Allston-Portland	0	0	0	8	84
114	Fairview-Bandon-Rogue	0	50	20	298	5
116	Badger Canyon-Grandview	0	0	5	79	768
119	Flathead Valley	0	0	0	74	745
120	Bend	0	0	7	206	169
121	Grays Harbor	0	0	0	2	17
123	Olympic Peninsula	0	0	0	0	16
124	Bellingham	0	0	0	2	193
125	Big Eddy-Celilo	0	0	0	270	90
126	Longview	0	0	0	0	1
129	North Idaho	0	0	0	0	2
130	Boundary-Colville Valley	0	0	0	755	886
132	Port Angeles	0	0	0	0	5
133	Centralia	0	0	0	0	148
134	East Lewis County	0	0	0	0	49
135	Fall River Lower Valley	0	0	0	0	58
136	Santiam-Chemawa	0	0	0	0	21
150	System Reactive Facilities	100	100	67	155	199
183	Ashe-Willamette Valley	200	150	111	102	4
185	Hot Springs-Bell	0	0	13	118	2,081
188	WNP #3 Integration	600	500	457	189	50
197	Northern Idaho	300	400	302	410	322
312	Albany	0	0	0	3	49
315	Clark County	0	0	0	88	56
316	Salem-Tillamook	0	0	0	81	159
605	Okanogan	400	300	213	57	1

Table B - 5 Year Planning Activity Funding Level (continued)

Major Project (Budget Item)			Obligations ($000)		
	FY 1980	FY 1981	FY 1982	FY 1983	FY 1984
612 Trentwood	0	0	61	0	1
614 Okanogan - Phase II	0	0	0	0	84
717 Goshen-Swan Valley	0	0	26	24	10
718 Surprise Valley	0	0	0	632	90
721 Midway-Grandview	0	0	0	4	89
770 Customer Services	400	400	425	1,010	452
810 General Structure and Improvements	400	400	427	732	335
820 Power System Control	400	400	412	931	1,197
830 Tools and Equipment	400	400	450	1,220	1,165
840 Preliminary Engineering	5,000	5,000	5,000	5,723	5,709
871 Transformer Additions	350	350	416	375	376
880 Miscellaneous Replacements and Capital Additions	300	300	296	452	332
Other	900	700	672	372	0
Total	11,750	12,250	13,275	19,165	19,322
Staff Allocations (FTE)	105	110	115	113	113

Table C - 5-Year Design Activity Funding Levels

Major Project (Budget Item)			Obligations (in thousands of dollars)			
		FY 1980	FY 1981	FY 1982	FY 1983	FY 1984
100	D.C. Intertie Uprating	0	92	400	360	124
101	Western Montana	0	2,600	3,480	640	280
112	Industrial Services	0	0	0	0	80
113	Allston-Portland	0	0	0	20	690
114	Fairview-Bandon-Rogue	0	130	67	104	0
116	Badger Canyon-Grandview	0	0	15	200	90
119	Flathead Valley	0	0	0	500	140
120	Bend	0	0	17	100	25
121	Grays Harbor	0	0	3	13	115
123	Olympic Peninsula	0	0	0	0	170
124	Bellingham	0	0	0	32	40
125	Big Eddy-Celilo	0	0	0	20	63
126	Longview	0	0	0	0	8
129	North Idaho	0	0	0	0	27
130	Boundary-Colville Valley	0	0	0	1,290	57
132	Port Angeles	0	0	0	0	57
133	Centralia	0	0	0	0	118
134	East Lewis County	0	0	0	0	110
135	Fall River Lower Valley	0	0	0	0	595
136	Santiam-Chemawa	0	0	0	0	16
150	System Reactive Facilities	90	95	68	93	166
183	Ashe-Willamette Valley	2,000	2,500	210	23	0
185	Hot Springs-Bell	195	420	137	990	400
188	WNP #3 Integration	500	600	264	50	32
197	Northern Idaho	100	400	360	85	16
312	Albany	0	0	0	40	34
315	Clark County	0	0	0	26	20
316	Salem-Tillamook	0	0	0	104	16
605	Okanogan	600	900	81	10	0

Table C - 5-Year Design Activity Funding Levels (continued)

Major Project (Budget Item)		Obligations (in thousands of dollars) FY 1980	FY 1981	FY 1982	FY 1983	FY 1984
612	Trentwood	0	0	96	2	5
614	Okanogan - Phase II	0	0	0	0	56
717	Goshen-Swan Valley	0	55	34	9	0
718	Surprise Valley	0	0	0	87	44
721	Midway-Grandview	0	0	0	40	25
770	Customer Services	500	550	570	525	375
810	General Structure and Improvements	400	450	465	430	440
820	Power System Control	1,200	1,250	1,223	1,930	1,263
871	Transformer Additions	230	230	215	340	264
880	Miscellaneous Replacements and Capital Additions	400	410	280	350	230
	Other	2,000	100	1,240	185	0
Total		8,215	10,690	8,869	8,598	6,191
Staff Allocations (FTE)		397	388	398	369	359

Table D - 5-Year Construction Activity Funding Levels

Major Project (Budget Item)		Obligations (in thousands of dollars)				
		FY 1980	FY 1981	FY 1982	FY 1983	FY 1984
100	D.C. Intertie Uprating	0	2	430	834	774
101	Western Montana	0	13	1,460	2,213	2,080
112	Industrial Services	0	0	0	0	0
113	Allston-Portland	0	0	0	0	0
114	Fairview-Bandon-Rogue	0	3	120	792	0
116	Badger Canyon-Grandview	0	0	0	230	100
119	Flathead Valley	0	0	0	0	0
120	Bend	0	0	0	0	430
121	Grays Harbor	0	0	4	0	0
123	Olympic Peninsula	0	0	0	0	0
124	Bellingham	0	0	0	0	0
125	Big Eddy-Celilo	0	0	0	0	10
126	Longview	0	0	0	0	0
129	North Idaho	0	0	0	0	0
130	Boundary-Colville Valley	0	0	0	0	647
132	Port Angeles	0	0	0	0	0
133	Centralia	0	0	0	0	28
134	East Lewis County	0	0	0	0	0
135	Fall River Lower Valley	0	0	0	0	0
136	Santiam-Chemawa	0	0	0	0	0
150	System Reactive Facilities	250	220	454	220	97
183	Ashe-Willamette Valley	3,500	3,900	60	676	46
185	Hot Springs-Bell	0	0	0	0	228
188	WNP #3 Integration	235	300	973	641	532
197	Northern Idaho	0	165	260	425	280
312	Albany	0	0	0	0	0
315	Clark County	0	0	0	0	233
316	Salem-Tillamook	0	0	0	0	278
605	Okanogan	400	630	903	90	7

Table D - 5-Year Construction Activity Funding Levels (continued)

Major Project (Budget Item)		Obligations (in thousands of dollars) FY 1980	FY 1981	FY 1982	FY 1983	FY 1984
612	Trentwood	0	0	0	0	0
614	Okanogan - Phase II	0	0	0	0	0
717	Goshen-Swan Valley	0	0	120	238	117
718	Surprise Valley	0	0	0	400	620
721	Midway-Grandview	0	0	0	0	0
770	Customer Services	500	560	1,360	2,096	1,390
810	General Structure and Improvements	200	260	260	1,095	501
820	Power System Control	860	1,000	1,140	2,870	2,100
871	Transformer Additions	500	560	1,375	1,260	500
880	Miscellaneous Replacements and Capital Additions	1,200	1,200	3,030	2,880	2,090
	Other	2,000	1,580	1,880	2,824	0
Total		9,645	10,393	13,829	19,782	13,088
Staff Allocations (FTE)		608	591	610	566	546

Question: Why do you state that "perhaps more than any other BPA program, the (transmission) construction program best reflects new priorities and realities in the region's electric energy supply system?" Is this consistent with your FY 84 request for the same level of funding as in FY 83?

Answer: That statement reflects the fact that before the Regional Act, the Construction Program typically comprised 60 to 70 percent of BPA's annual budget obligations; whereas with our new, expanded responsibilities under the Regional Act, the Construction Program now comprises about 10 percent of our total annual budget obligations. Construction Program funding, as shown in our FY 1984 Congressional Budget Presentation, shows obligational requirements of $210 million, $219 million, and $217 million for fiscal years 1982, 1983, and 1984, respectively. Total BPA budget obligations for that period, however, increase from $1.5 billion to $2.7 billion, due primarily to the increasing net-billing costs for thermal acquisitions and the new residential energy exchange program.

The funding level for construction is comparable for FY 1983 and FY 1984 mostly because of deferrals from prior years into those years, coupled with a declining level of new starts in FY 1983 and FY 1984 in response to reduced load growth rates in the region.

Question: Briefly discuss the problems being experienced with construction of the 500-kV Colstrip powerlines. Do you anticipate delays? What impact would delays have on future budgets?

Answer: Construction is progressing on the first portion of the transmission facilities to Garrison where interconnection with the existing BPA facilities will be made. Mild weather this winter has allowed construction to proceed, and energization of Colstrip Unit 3 and facilities to Garrison are expected by the scheduled date of October 1983.

Previously, there was controversy over the proposed routing west of Garrison. Now the State of Montana and the Federal agencies are both recommending the Garrison-to-Spokane line be located on a new route passing south of Missoula, connecting to the existing 500-kV line at a new substation near Taft. State hearings will be held in March. A final Montana Board of Natural Resources and Conservation decision and the Federal Record of Decision are anticipated in April 1983.

This will allow construction of the facilities needed for Colstrip Unit 4 to proceed with a scheduled energization date of October 1985. Unit 4 is expected to be in service 3 months earlier, but until October 1985, all four plants will not be able to operate together at full power.

BPA does not anticipate delays from these schedules. If plant completion is delayed, however, the effect would be to move BPA transmission costs from currently budgeted periods to later fiscal years.

Repayment

Question: Your statement indicates an unexpected shortfall of revenues in FY 1983 that could affect the payment of interest payments. Please explain your efforts to eliminate the cumulative deferral and stay current.

Answer: I am dealing with the anticipated revenue shortfall by undertaking substantial cost-cutting measures in FY 1983 and I have challenged the Supply System to reduce its cash requirements between now and 1985 on the net-billed projects. These actions will reduce any shortfall we could have incurred had we continued expenditures at our planned level. In addition, we are planning a rate adjustment effective in November 1983 which will insure adequate revenues to remain on schedule with the repayment of the cumulative deferral in FY 1985 as planned.

Strategic Planning

Question: Please describe the strategic planning process which you have developed at BPA. Why is it necessary? Who is involved in it?

Answer: Our strategic planning process began in the fall of 1981 when my key managers and I gathered for a 2-day retreat. During the course of that weekend we developed a mission statement which is an expression of the character of the agency and provides a broad framework for our decisions. Since that time, my top managers and their key staff have met four times to further map out BPA's strategic direction. At three of these sessions, I used the services of a top business consultant to help us assess critical elements and reach agreements on strategic choices and critical action plans.

This strategic planning process has had significant payoffs during these turbulent times. It has allowed us to establish agency direction, develop cohesion, and insure BPA's fiscal integrity as we implement the Regional Act. It has provided the necessary integration of our program planning, budgeting, and ratemaking processes. And it has greatly enhanced the financial awareness of all BPA managers and employees.

Question. How much funding is allocated for this activity in FY 83 and FY 84?

Answer. The costs have been relatively low, compared to a total agency budget of over $2 billion. In addition to normal staff time and associated travel costs, during FY 1982 we used about $10,000 in contracts to support our strategic planning activities. In FY 1983 we will spend about $18,000 in contracts for strategic planning, and in the FY 1984 budget we are allocating approximately $15,000.

Combining Federal and State Power Programs

Question: Mr. Cross, your statement mentions the possibility of combining the State power program and the Federal power program. Could you provide a little more detail on how this would be accomplished?

Answer: Combining the State and Federal power programs in Alaska requires three basic steps.

The first involves establishing a set of proposed terms which adequately satisfy the interests of the State and Federal Government and the customers of the Federal projects.

The second involves seeking the necessary State and Federal legislation to authorize the transfer.

The third step would be completing the necessary regulatory step and actions necessary to handle Federal contractual commitments.

Question: What are some of the problems and issues to be resolved?

Answer: Some of the problems and issues to be resolved include: the time frame in accomplishing the transfer; the repayment of obligations to the Treasury; what the impact of transfer on allocations and rates would be for present customers; and whether the transfer would result in a loss of key personnel vital to the operations of the projects.

Deferred Equipment Purchases

Question: You have had to defer equipment purchases because of emergency work related to your transmission towers. When do you expect these deferred items will find their way back into the budget?

Answer: We deferred two items because of the emergency work. These deferred items will be reconsidered during formulation of our FY 1985 budget.

Question: How much does the equipment cost?

Answer: The first item is the shunt reactors for the Snettisham project. We don't have a current estimate, but our initial request of $271,000 appears to be too low. We have scheduled a design study and new cost estimates for FY 1983.

The second item is the static exciters for the Eklutna project. Our initial estimate of $200,000 for the exciters appears to be about right.

Question: Is this equipment critical to system reliability and operation?

Answer: The deferred items are not exceptionally critical from the reliability standpoint.

Question: What would be the impact in terms of service disruption and the cost of emergency repair if the existing equipment failed?

Answer: The new exciters are needed primarily to eliminate costly maintenance problems with existing equipment. The shunt reactors would improve overall reliability of the Juneau power system and would shorten the time needed to restore the system after outages occur.

Crater Lake

Question: What is the position of the State of Alaska regarding construction of the Crater Lake unit of the Snettisham hydropower project?

Answer: The State has always favored Federal completion of the Crater Lake unit under existing Snettisham project authorization.

Bradley Lake

Question: Since the $200 million Bradley Lake hydropower project will now be constructed by the State, how likely is it that the State will also want to finance the Crater Lake unit which is estimated to cost around $70 million.

Answer: I cannot speak for the State on this question. I suspect the State would be willing to consider some cost sharing.

Snettisham Project Power Sales

Question: Can you give the Committee a feel for how the sales of power from the Snettisham project have increased over the last few years and how the power sales compare with the capacity currently available?

Answer: Actual Snettisham sales in FY 1982 were 140 million kilowatthours and we expect sales of 171 million kilowatthours in FY 1983. The 1983 amount is slightly above firm energy capability for the project.

Using net generation figures, which include our line losses and project use of power, Snettisham production has increased from 95 million kilowatthours in FY 1980 to 117 million in FY 1981, and 147 million in FY 1982.

Future Power Needs

Question: What are your projections for future power needs in the Juneau area relative to the need for the Crater Lake Unit of the Snettisham project?

Answer: Total requirements for Juneau in FY 1982 were 203 million kilowatthours. Our latest study indicates an increase to 356 million kilowatthours by 1990.

Crater Lake would add 106 kilowatthours per year. We estimate that 60 to 70 percent of this new energy could be used in 1987, if Crater Lake is available by that time.

QUESTIONS SUBMITTED BY SENATOR McCLURE

Fish and Wildlife

Question: On page 14 of your statement you indicate that a substantial part of the budget increase provides for new programs directly related to the Regional Act, including "fish and wildlife support." I presume that statement refers to the fish and wildlife mitigation plan proposed by the Northwest Power Planning Council. If I am correct in that assumption, it would seem to me you are indicating an intent to implement all or part of the plan. That is somewhat troubling because it is my recollection and understanding that our intent in the Act was for Bonneville to make its own analysis of the Council's recommendations and should exercise independent judgement as to their implementation. Does your statement mean that you have decided to move to implement the Northwest Power Planning Council's fish and wildlife mitigation plan as proposed?

Answer: BPA has worked very closely with the Council, their staff, and the fisheries agencies during the development and review of the Plan. We are satisfied that the Plan meets the Regional Act's intent. We are implementing those portions of the Plan which are our responsibility. However, the Plan contains some measures which have not yet been adequately defined or evaluated; their implementation must await their full development.

Adequate safeguards are in place to insure that proposed expenditures are necessary and appropriate. As Federal laws and regulations require of us, we will insure that BPA funds are spent prudently, that our expenditures are consistent with sound business principles, and that costs are reasonable and commensurate with anticipated benefits. Our procurement procedures subject individual proposals for funding to detailed scrutiny of project design, cost-effectiveness, and coordination.

Question: If so, what sort of analysis or independent study of the plan has lead to that decision; or if a decision has not been made, do you intend to initiate an independent study before including the plan in the next rate making?

Answer: BPA participated in the evaluation of measures during the Fish and Wildlife Program's development. Many program measures call for preliminary feasibility studies prior to the implementation of operational changes, facility construction, and habitat enhancement projects, which will help to insure that BPA funds are well spent. BPA has examined the cost-effectiveness of the Plan's components and conducted its own detailed analysis of the Plan's financial impacts in the current and future fiscal years.

BPA is supporting detailed, inter-agency planning for program implementation to insure systematic, cost-effective implementation of program measures. Proposals received in accordance with the Plan are being evaluated for us by the expert BPA staff.

Question: If you do not intend to do an independent study prior to including the plan in the next rate making process, aren't you injecting an arbitrary and prejudicial element into the rate? Aren't you also effectively pre-ordaining implementation of the entire plan without independent analysis?

Answer: The Fish and Wildlife Plan already reflects considerable compromise between regional fish interests and the utility community. The published program is not the first request or recommendation of the fish interests or Northwest Power Planning Council. In addition, because BPA and other qualified agencies are insuring review of program measures prior to implementation, we do not believe we are either acting arbitrarily and prejudicially or pre-ordaining Program implementation without independent analysis. In addition, we encourage all parties to the rate filing to put their views on record regarding proposed expenditures for the Plan. Those views will be given close scruting and taken into account in our decisions regarding the Plan's implementation.

Question: One of the concerns I have with the Council's fish and wildlife plan is that it appears to recommend actions which attempt to mitigate past decisions and activities rather than planning for fish and wildlife mitigation considerations in future actions as the legislative intent clearly indicates. How many megawatts of power would be lost in the region if the plan is put into effect as now recommended?

Answer: BPA is currently reassessing the power loss resulting from Water Budget implementation to reflect changes in how the Water Budget was defined in the final Fish and Wildlife Program. The Northwest Power Planning Council stated in the final Program that the Water Budget was expected to result in a regional loss of firm energy load carrying capability of approximately 550 megawatts. In our comments to the Northwest Power Planning Council on the Draft Fish and Wildlife Program, we stated that "Bonneville's assessment confirms that the magnitude of the loss in firm energy load carrying capability as a result of providing the proposed Water Budget is about 500 to 550 megawatts."

Question: How much is attributable to mitigation of past activities?

Answer: The Fish and Wildlife Program and BPA's actions to implement program measures are aimed at mitigating the present-day effects of the hydroelectric system. BPA does not intend to compensate for fish and wildlife losses that occurred in past years. The Fish and Wildlife Program states that mitigation efforts "must take the system as it exists and provide a reasonable equivalent for" the effect of the hydroelectric system on fish and wildlife. BPA agrees with this position.

The entire power loss resulting from Water Budget implementation is attributable to the present-day effects of the hydroelectric system on the anadromous fisheries resource. The Water Budget will not provide conditions for out-migration more favorable than would exist in the absence of the dams.

Question: Is the entire power loss reflected in the rate making process?

Answer: Most, but not all, of the loss of firm capability resulting from the Water Budget will occur at Federal hydroelectric projects. BPA's proposed rates account for the loss at Federal projects. They also reflect the assumption that BPA will replace all power losses incurred by the Idaho Power Company in providing Water Budget flows from Brownlee Reservoir, but that BPA will not replace power losses at other non-Federal facilities resulting from the Water Budget. As requested by the operators of the non-Federal mid-Columbia hydroelectric projects, BPA may assess whether a portion of the power losses at these projects are not attributable to the projects themselves, and thus qualify for replacement by BPA. BPA may also need to assess whether a portion of the Idaho Power Company's losses are attributable to the impacts of the Company's facilities, and thus ineligible for replacement.

Question: What would this mean in dollar amounts, both in terms of actual cost of administration as well as in rate increases needed to cover the extra costs?

Answer: In BPA's comments on the Draft Fish and Wildlife Program, we stated:

> Bonneville's figures indicate the cost per kilowatthour (of the Water Budget) will be close to 1.8 mills if spread equally over all of Bonneville's sales. For a residential customer using 15,000 Kwh per year, this would amount to about $27 dollars per year.

The actual effect of Water Budget implementation during Fiscal Years 1984 and 1985 is expected to be less than $27 dollars per year. The figure of $27 dollars per year was calculated to measure the long-term costs of Water Budget implementation, and assumes that the loss of firm capability must be replaced with new resources. This is not currently the case because of the region's electric power surplus. In FY 1984 and 1985, the Water Budget will reduce the amount of surplus firm capability available to the region. The value of that capability will be less than if the region were facing a deficit. As a practical matter, the revenue impact of Water Budget implementation will vary with market and water conditions.

The effect of Water Budget implementation on BPA's costs of administration is expected to be negligible. However, BPA will provide a limited amount of money for salaries for the two Water Budget managers hired by the region's fish and wildlife agencies and Indian tribes, respectively.

WESTERN AREA POWER ADMINISTRATION

STATEMENT OF ROBERT L. McPHAIL, ADMINISTRATOR

Mr. McPHAIL. Mr. Chairman, it is a pleasure to be here today to present the 1984 budget request for the Western Area Power Administration. The request is essentially a no-new-thrust budget. As of October 1, 1982, we had about $67 million of unobligated funds. There were two major reasons for this carryover: One, we had an excellent water year in 1982 which saved us about $33 million in purchase power expenditures. Second, we were unable to obligate about $27 million which was appropriated for our participation in the Rifle-San Juan 345-kV transmission line in western Colorado.

Our budget authority for 1983 was reduced to about $150 million in the Second Continuing Resolution for fiscal year 1983 and we were allowed to add to that the $67 million carryover for a total 1983 budget of $217.2 million.

Our fiscal year 1984 budget request is only slightly above the fiscal year 1983 budget at $220.1 million.

REVENUES, RATES, AND REPAYMENTS

In 1982 we sold 36.1 billion kilowatt-hours for revenues of $392 million. We estimate in 1983 our power sales will amount to 37.2 billion kilowatt-hours and revenues at $454 million. We have several rate increases in process right now, the most drastic of which is the rate increase that we are proposing for the Central Valley project in California.

We are proposing to raise the rates in northern California from about 10 mills per kilowatt-hour, which is the present rate, to about 40 mills per kilowatt-hour in about 1986. It would be a stepped rate increase in California.

As of September 30, 1982, the total Federal investment in all of our power systems was $3.7 billion, of which $1.7 billion has already been repaid. Since these projects first went on line, our total revenues are $4.7 billion.

WESTERN ISSUES

We have several controversial power marketing issues on the table at the present time.

One of the most controversial is the Hoover Dam marketing plan. Hoover contracts were signed in 1937; they were 50-year contracts with a provision for renewal.

Part of Hoover power goes to Southern California Edison Co., which is a nonpreference company with a right to renew. A large part of the power goes to the city of Los Angeles. Also, a large part of it goes to the Metropolitan Water District to pump water from the Colorado

River into the southern California area. At the present time, the States of Arizona and Nevada have taken the position that they are each entitled to a third of the output of Hoover and that California intake should diminish to give them additional power. They have gone to court to challenge the contracts and our marketing plan. It is a very controversial issue.

We are in the process of reallocating power in the Colorado River storage project and the western division of the Pick-Sloan project which is in the lower Missouri region. These contracts will expire in the late 1980's and we are in the process of determining how we should reallocate this power. These items are very controversial because the current power rates are more reasonable than alternate sources of power, and it's a finite amount of power that we have to allocate. So, therefore, everyone wants as much as they can get.

Mr. Chairman, that concludes my summary statement. I would like to submit my prepared statement for the record.

Senator McClure. I think that last statement summarizes everything we hear about. [Laughter.]

Everybody wants all they can get.

Your entire statement will be placed in the record in full.

[The statement follows:]

STATEMENT OF ROBERT L. MCPHAIL

Mr. Chairman and Members of the Committee:

It is a pleasure to appear before you today to present the FY 1984 budget request for the Western Area Power Administration (Western). I will summarize the major program areas in our request and discuss some of our significant accomplishments during this past fiscal year.

SUMMARY OF BUDGET REQUEST
(Dollars in thousands)

Appropriation	FY 1983 Program	FY 1984 Request	Change
Construction, Rehabilitation, Operation and Maintenance Fund	$216,463	$219,630	+$3,167
Emergency Fund	708	500	- 208
TOTAL	$217,171[1]	$220,130	+$2,959

Western's appropriation request for FY 1984 is $220.1 million, an increase of $2.9 million above the total funds available for obligation in FY 1983. This increase is based on a comparison of new budget authority requested in FY 1984 and the total program funds available in FY 1983.

Our total FY 1983 program of $217.2 million consists of appropriations of $150.1 million plus $67.1 million of FY 1982 carryover. These amounts are in accordance with the intent of the FY 1983 Second Continuing Resolution, and will provide Western with sufficient monies to meet its planned goals and objectives in FY 1983. The two major reasons for the large carryover were excellent water conditions in 1982 in the Northwest and the Dakotas (reducing our purchased power requirements to meet customer loads) and delay of construction of 345-kV transmission facilities in western Colorado.

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[1] Includes $66.7 million of prior year carryover for Construction, Rehabilitation, Operation and Maintenance and $.4 million for the Emergency Fund.

CONSTRUCTION, REHABILITATION, OPERATION AND MAINTENANCE FUND

In FY 1984, we are requesting $219.6 million under the Construction, Rehabilitation, Operation and Maintenance fund. Specific activity dollar amounts of this fund compared to funds available in FY 1983 are as follows:

Activity	FY 1983 Program	FY 1984 Request	Change
	(Dollars in thousands)		
Construction and Rehabilitation	$100,095	$ 78,767	-$21,328
Systems Operation and Maintenance	58,200	72,863	+14,663
Purchase Power and Wheeling	58,168	68,000	+9,832
TOTAL	$216,463	$219,630	+$ 3,167

CONSTRUCTION AND REHABILITATION

The FY 1984 budget request for construction and rehabilitation is $78.8 million, a decrease of $21.3 million below the FY 1983 program. This request is required in order for Western to meet its mandated responsibility for the delivery of power and energy to its customers. Western must rehabilitate, upgrade, or replace transmission facilities which are worn out, overloaded, and damaged in order to maintain the reliability of system operations, meet current safety and environmental standards, and serve customer loads. Western constructs new transmission facilities to avoid major outages, interconnect with other utilities to offset the use of higher cost energy, provide increased capacity by reducing the overburdening of existing facilities, and to further Western's oil conservation program.

In FY 1982, construction was completed on 12 substation additions and 284 miles of transmission line. During FY 1983, we plan to complete work on 9 substation additions and 122 miles of transmission line and in FY 1984 we plan to complete work on 9 substation additions and 158 miles of transmission line.

In FY 1982, the committee directed Western to initiate work on the Great Falls-Conrad transmission line. The FY 1984 request includes

$2.5 million for initiating construction activities on the Great Falls-Conrad 230-kV transmission line, which is estimated to cost a total of $23.9 million. This new line will relieve present overloading in the northcentral area of Montana.

We will continue preconstruction activities such as planning, environmental activities, field data collection, design and specifications development, and land and rights activities for several program items related to ongoing improvements to Western's transmission system. Some of the more significant improvements scheduled for work in FY 1984 include: the Liberty-Coolidge 230-kV transmission upgrade, which will replace a severely deteriorated wood-pole line and provide increased capacity to serve Central Arizona Project pumping loads in southern Arizona; the Thermopolis-Alcova 230-kV transmission upgrade, which will provide increased transfer capability through Wyoming, relieve local overloads, and replace old deteriorated 69-kV wood-pole transmission line structures; and the Gering-Archer 115-kV transmission line rehabilitation project, which will relieve existing overloads in the Wyoming and Nebraska area and, again, replace a badly deteriorated wood-pole transmission line.

WOOD-POLE REPLACEMENT PROGRAM

Western will continue in FY 1984 to inspect and replace wood-pole transmission structures that have exceeded their useful life and, consequently, pose a hazard to our maintenance crews and the general public. Western operates and maintains over 8,000 miles of wood-pole transmission line (approximately 53 percent of the total transmission system) consisting of approximately 70,000 wood-pole structures. Western has an inspection and treatment program where each pole is inspected at selected intervals to determine its condition. When it is cost effective, poles are treated as necessary to extend their life expectancy. When the treatment of wood poles is not cost effective, poles or lines are scheduled for replacement. In FY 1982, we inspected wood-pole structures on 362 miles of line and replaced almost 2,000 wood poles. During FY 1983, we plan to inspect wood-pole structures on about 560 miles of line and an additional 500 miles of line in FY 1984.

WESTERN COLORADO 345-KV ADDITIONS

There are three 345-kV transmission lines in Western's western Colorado program. From north to south, there is (1) the upgrade of Western's existing 98-mile Craig-Rifle line from 230 kV to 345 kV, (2) the construction (jointly with Colorado-Ute Electric Association and Public Service Company of Colorado) of the 275-mile Rifle-San Juan 345-kV line, and (3) the upgrade of the 8-mile Four Corners-Shiprock 230-kV line to 345 kV.

Western awarded construction contracts of $9.7 million on July 7, 1982, and $1.4 million on September 20, 1982, respectively for upgrading the existing Craig-Rifle and Shiprock-Four Corners 230-kV transmission lines in Colorado and New Mexico to operate at 345 kV. Our FY 1984 request provides $15 million for continuing the development of new and uprated transmission facilities in western Colorado and northern New Mexico.

However, there have been delays associated with the Rifle-San Juan line. Last year, we advised the committee that the Public Utilities Commission of Colorado had denied Colorado-Ute Electric Association a permit for construction of double-circuit 345-kV transmission facilities between Rifle, Colorado, and San Juan, New Mexico. Western's intended financial participation in this part of the overall program was to be 30 percent of the total cost.

Subsequently, Colorado-Ute Electric Association, Public Service Company of Colorado, and Western reformulated the project. Colorado-Ute Electric Association and Public Service Company of Colorado have applied to the Public Utilities Commission for a permit to construct a single-circuit 345-kV line from Rifle to San Juan. Western intends financial participation to be 50 percent of the total costs of this reformulated project.

Currently, the Public Utilities Commission is in the process of holding hearings on Colorado Ute's and Public Service Company's application. A decision from the Commission is not expected before this summer. A permit is needed from the Commission before construction can start on this line as a joint participation project.

REIMBURSABLE CONSTRUCTION

Western, under reimbursable arrangements with the Bureau of Indian Affairs, is to provide the power supply for the pumping requirements for the Ak-Chin Water Supply Project in central Arizona as authorized by the Ak-Chin Water Rights Settlement Act.

However, Western's participation in this project has been curtailed as a result of the Bureau of Indian Affairs funding problems. Western intends to finish some design and rights-of-way work in FY 1983 within available funding. Additional work is dependent on the resolution of Bureau of Indian Affairs funding issues.

JOINT PARTICIPATION

Western encourages participation and participates with other utilities in joint planning and operating studies and in the construction of needed transmission facilities. It is through cooperative study efforts that benefits of joint construction projects are first identified and formulated. This joint participation lowers costs to the Government and other participants, minimizes environmental impacts by avoiding duplication of facilities, and allows economy exchanges of energy between utilities.

Western has been very successful in developing joint participation arrangements. For example:

- In cooperation with Basin Electric Cooperative and Montana-Dakota Utilities Company, construction was completed on July 1, 1982, on the 328-mile Miles City-New Underwood 230-kV transmission line and terminal facilities in Montana, North Dakota, and South Dakota.

- Western is participating with Salt River Project, the Southern California Public Power Authority, and other utilities in the Southwest in developing the Mead-Phoenix DC Intertie project. The major portion of the funding for this project will come from non-Federal utility interests. It is expected that project feasibility will be determined by mid-1984.
- Western, in cooperation with Basin Electric Cooperative, awarded a contract on August 16, 1982, in the amount of $27.9 million for the design and construction of a Direct-Current (DC) Converter Station at Miles City, Montana. The FY 1984 request includes $8.9 million for equipment installation, checkout, and testing activities. The project is scheduled for completion in early 1985.
- Western, in cooperation with the Bonneville Power Administration, is continuing to study the feasibility of constructing a DC transmission line from Celilo, Oregon, to Mead, Nevada, to connect the Pacific Northwest and Pacific Southwest regions, as authorized by Public Law 88-552.

INTERAGENCY AGREEMENTS

Under interagency agreements, Western also provides transmission services to the Bureau of Reclamation water development projects. Currently, Western is conducting planning studies to provide transmission service to seven irrigation pumping plants associated with the Bureau of Reclamation's Dolores Project in southwestern Colorado. Alternative methods of providing the service include constructing an all-Federal 115-kV and 46-kV transmission system, or using the existing systems of Colorado-Ute Electric Association and Empire Electric Association. From an economic and environmental perspective, the preferred approach is to purchase capacity in the existing subtransmission systems of Colorado-Ute and Empire Electric. Transmission service will be provided to the project beginning in 1985, with the last of the plants scheduled to receive service in 1988.

SYSTEMS OPERATION AND MAINTENANCE

Our FY 1984 request for system operation and maintenance totals $72.9 million, an increase of $14.7 million above the total funds available for obligation in FY 1983. This request will provide for operation and maintenance expenses on transmission lines, associated substations, communication facilities, and for power marketing activities. The increase in the FY 1984 budget request is to cover additional costs for required full-time personnel and materials and supplies to operate and maintain recently completed facilities; for acquisition and preventive maintenance of a fixed-wing aircraft; for contract support services; and for increased costs of system replacements.

Of the total FY 1984 budget request, $60 million is for classified and wage board employee salaries, travel and transportation, rents, communications, utilities, materials and supplies, data processing, and administrative and other general expenses.

Included in the total request is $12.2 million for system replacements and additions. Of this amount, $4.2 million is required to purchase critical mobile equipment to maintain Western's electric power systems; and $7.5 million is required to purchase telemetering, supervisory control, radio and protective relaying equipment, circuit breakers, and transformers to improve system reliability and operational efficiency, and for replacement and disposal of devices containing polychlorinated biphenyls. Additionally, $.5 million is required for various maintenance and warehouse facilities for line crew workspace, storage of materials and supplies, storage of electrical and transportation equipment, and energy efficiency improvements to existing facilities. This request also includes $.7 million for continuing customer-oriented activities under the Conservation and Renewable Energy Program.

Western is continuing to improve management efficiency and reduce administrative costs. For example, Western is implementing a Maintenance Information System at its field offices to account for man-hours expended against specific equipment and maintenance activities. A Warehouse Inventory System has also been implemented throughout Western. In addition to improving local inventory control, this system provides a Western-wide data base accessible to all inventory managers. In addition, Western recently completed work on its Power Marketing Operations Complex near Loveland, Colorado. This facility reduces costs by consolidating functions previously performed at several other locations and serves as a central area control center for power marketing activities for the Colorado-Wyoming-Nebraska area.

PURCHASE POWER AND WHEELING

The FY 1984 budget request for purchase power and wheeling is $68 million, an increase of $9.8 million above the total funds available for obligation in FY 1983. This request will provide for the purchase and wheeling of power to meet existing contractual commitments and for participation in the oil conservation program.

The increase of $9.8 million is primarily attributed to higher costs for energy purchases for the Central Valley Project (CVP) in California. With expiration of the Centralia Thermal Project agreement in December 1981, Western must now purchase power from other sources, generally at greater cost, in order to meet CVP contractual commitments.

I wish to point out that Western's future purchase power funding requirements, primarily for the CVP in California, will increase significantly because of depletion of lower-cost banked energy, and the requirement to purchase higher-cost energy from the open market to meet load requirements under existing contracts. Our FY 1984 budget level is based on contract commitments made in the mid-1960's. However, negotiations are currently under way which may lead to funding level reductions through energy imports and through bill crediting arrangements. We are concluding arrangements for an Energy Exchange Account with Pacific Gas and Electric Company (PGandE) which will level purchase power and wheeling appropriations needed between good and adverse water years.

BILL CREDITING

The bill crediting procedure involves contractual arrangements with one or more CVP customers whereby the customers agree to assume Western's obligation to pay for power and energy delivered from power generating utilities. In return, the participating customers are credited on their bills for CVP power by an amount equivalent to the amounts paid to the generating utility. Since the customers will not be required to pay an amount to the generating utility above the amounts of their CVP power bills, there may be times during which Western would pay for the difference out of its purchase power and wheeling budget.

Last year we presented this concept as a procedure we were investigating. I am pleased to report that Western has discussed this procedure with its CVP customers and the reaction has been favorable. We are now in the process of negotiating the required documents.

Our first effort involves Basin Electric Power Cooperative. The degree to which this procedure will reduce the requirement for appropriations for purchase power depends on the number of CVP customers willing to provide funding. However, discussions related to the purchase of energy for transmission from the Dakotas to CVP indicate that the customers are in favor of funding this energy purchase.

ENERGY IMPORT TO CVP

The FY 1984 budget request is based on a blend of Federally generated energy (assuming average water conditions), banked energy, and minor energy support purchases to meet existing firm contracts. Western will continue to work on arrangements to import energy into the CVP system at a cost less than the cost of energy from PGandE's fossil-fuel plants.

Western and Basin Electric Power Cooperative are currently in the process of constructing the Montana ac-dc-ac tie previously funded (in part) by this committee. The tie is scheduled for completion in 1985. Also, Western has completed negotiations with the Bonneville Power Administration for use of its transmission system, and has completed arrangements for use of the Colstrip Project transmission system across Montana. With these arrangements completed, Western will have the ability to transmit power from the Dakotas to the CVP starting in 1985. We are also pursuing with Bonneville Power Administration and other entities in the Pacific Northwest the possibility of importing low cost energy to meet CVP firm requirements.

At the Navy's request Western has agreed to aid in development of the Navy's geothermal resources near Fallon, Nevada by serving as the Navy's power marketing agent. Western will arrange for any wheeling and interconnection agreements needed to move power that is excess to the Navy's needs at the Fallon Naval Air Weapons Training Complex (NAWTC) to meet other Navy loads in the State of California.

RESOURCE COORDINATION PROGRAM

Western is continuing the Resource Coordination Program initiated in 1981. This program is an arrangement in which Federal hydroelectric generation is integrated with thermal generation. Integration of such hydro and thermal generation permits the shaping of surplus energy to maximize its availability and value for the displacement of fossil-fuel generation.

The operational objective of resource coordination is to operate the thermal plants at their most efficient output. To the extent that such operation produces more energy than required to meet the load obligations of the thermal plant owners during daily and seasonal low-load periods, the excess energy is used to supply Western's load obligation. This enables Western to back off its hydroelectric generators.

Backing off Western's hydroelectric generators means that the water which would have been used for generation during the low-load periods remains stored in the reservoirs. This stored water is subsequently used to generate and sell surplus energy during daily and seasonal high-load periods when the energy is most valuable. The benefits of hydro-thermal integration are then shared by Western and the contributors of such surplus energy.

Revenues received from this program are applied to repayment of the Federal facilities used.

COLORADO RIVER BASINS POWER MARKETING FUND OPERATING EXPENSES

Western's FY 1984 estimated obligational authority requirement under this revolving fund is $101.5 million for power marketing and transmission expenses, an increase of $8.1 million above FY 1983. The increase above FY 1983 is primarily because of increased expenses for system replacements. This increase is partially offset by a decrease in purchase power costs associated with Western's oil conservation program.

Under the Colorado River Basins Power Marketing Fund, which encompasses the Colorado River Storage Project (CRSP), the Fort Peck Project, and the Colorado River Basin Project, (including a portion of the expenses of the Bureau of Reclamation and the Corps of Engineers), all operation and maintenance and power marketing operating expenses are financed from the project revenues collected by Western. Additionally, project revenues above actual operating expenses are returned to the United States Treasury to repay Federal investments.

Colorado River Storage Project

In FY 1984, $76.4 million will be used to cover project expenses associated with power system operation and maintenance of the CRSP, including $54.3 million for purchase power and wheeling and oil conservation program activities. We expect to save about 3 million equivalent barrels of oil and increase income appreciably over expenses through our oil conservation program under this appropriation account.

Additionally, about $7.2 million of this request will be used to cover replacement of substation equipment, mobile equipment, various tools and work equipment, and communication and control equipment, including supervisory control and data acquisition (SCADA) equipment at the Montrose, Colorado, power operations center. Most of the equipment at the center is now obsolete, having been designed more than 20 years ago. Operating and maintenance costs of the existing equipment are high, replacement parts are difficult to obtain, additions and modifications are difficult and costly to implement, and system performance is generally inadequate by current standards. New, state-of-the-art SCADA and AGC systems are needed to replace and consolidate all of the existing systems under one supervisory control unit.

To provide the required level of quality and reliability will demand sophisticated computer-based equipment. Such a system will offer not only increased reliability, but will also provide greater versatility in programming and increased flexibility for expansion as new stations and/or powerplants are added.

In order for the CRSP system and others to be operated and controlled in an economic manner consistent with utility industry standards and practices, it is essential that the existing SCADA and AGC systems be replaced. The remainder of the FY 1984 budget request will cover normal operation and maintenance activities, interest payment on the investment, and Conservation and Renewable Energy Program expenses.

Fort Peck Project. Western requires $24.1 million in FY 1984 to operate and maintain the Fort Peck Project transmission system and market available power. This request includes $2.4 million for Corps of Engineers expenses associated with operating and maintaining the power generating facilities. It also provides $14.6 million for continuation of rehabilitation work on the Fort Peck-Havre 161-kV transmission facilities.

Colorado River Basin Project. The budget request of $.9 million provides for power marketing expenses associated with the Navajo Generating Station at Page, Arizona, and power marketing and operation and maintenance expenses for the Central Arizona Project.

EMERGENCY FUND

Western is requesting $500,000 for emergency expenses in the event of unforeseen or unusual conditions causing, or threatening to cause, interruption in power service. This request is consistent with Western's cost experience for this program.

Western is also proposing a change in appropriation language to fund emergencies from power revenues rather than from annual appropriations. To effect this change, the FY 1984 request will initially establish an Emergency Fund of $500,000 which will be replenished as required from project power revenues for which funds were expended on an emergency basis.

MISSION AND ORGANIZATION

Western is a Federally-operated electric power marketing agency responsible for the delivery and sale of power to over 530 wholesale customers consisting of cooperatives, municipalities, public utility districts, investor-owned utilities, Federal and State agencies, and irrigation districts. These customers provide service to millions of retail power customers in all or part of the following 15 States: Arizona, California, Colorado, Iowa, Kansas, Minnesota, Montana, Nebraska, Nevada, New Mexico, North Dakota, South Dakota, Texas, Utah, and Wyoming. Western is responsible for the operation and maintenance of 16,178 miles of transmission lines, 228 substations, and various appurtenant power facilities in a 1.3 million-square-mile geographic area. Electric power marketed by Western is generated at 47 hydropower generating plants by the Bureau of Reclamation, the Corps of Engineers, and the International Boundary and Water Commission. Western also markets the United States 24.3 percent entitlement from the Navajo coal-fired plant near Page, Arizona. The current installed generating capacity of these plants is 8,321,053 kW.

The major goal of Western is to market Federal power and to provide reliable electric service at the lowest possible cost consistent with sound business principles. Major program objectives are to conduct an ongoing operation, maintenance, and replacement program; plan and manage energy supplies; and to plan, design, and construct facilities to assure a reliable power system adequate to deliver power to customer load centers.

STAFFING

The FY 1984 budget request provides for 1,423 full-time equivalents (FTE) for Western to carry out its mission. Of these 1,423 FTE, 1,338 are full-time permanent, and 85 are other than full-time permanent. This request represents an increase of 74 FTE above our FY 1983 level of 1,349 FTE. The additional 74 FTE will be used to increase system reliability through more frequent scheduled preventive maintenance and diagnostic testing, increase system capacity and capability through design and construction of system additions and upgrades, and provide increased revenue to the U.S. through the more timely implementation of rate adjustments.

POWER RATES

Western is required by law to maintain rates which are adequate to meet the repayment requirements of each project. In order to assure that rates are sufficient, an annual repayment study is prepared on each power project. The annual study determines if the project rate is adequate to meet repayment of costs allocated to power, and if not, to establish rates which will cover these costs.

Repayment requirements are basically the same for all projects. Essentially, the requirement is to repay, with interest, all costs which are allocated to power facilities, plus annual operation and maintenance expenses including purchased power and wheeling expenses. In addition, most multipurpose projects have a portion of irrigation costs which are paid by power revenues. Irrigation costs assigned to be repaid by power revenues are not subject to interest.

Western, since its establishment in 1977, has implemented one rate increase for the CVP, one for the CRSP, two for the Rio Grande Project, one for the Parker-Davis Project, one for the Fryingpan-

Arkansas Project, and one, with two parts (Eastern Division and Western Division), for the Pick-Sloan Missouri Basin Program. Also, a special rate for the sale of economy energy under the Loveland-Fort Collins Area Office's Resource Coordination Program, was implemented. We are currently in the process of completing a second increase for the CVP and also for the CRSP. A special Western-wide split-savings rate has been proposed, and we are diligently considering comments received on this proposal.

The Federal Energy Regulatory Commission (FERC) recently confirmed and approved on a final basis a rate increase for the Rio Grande Project, New Mexico. This rate had been put in effect beginning on September 1, 1982, by the Assistant Secretary for Conservation and Renewable Energy. The new rate will now provide sufficient revenues to put this project in sound financial condition for the first time since 1950. This higher rate is possible because the costs of power from alternative sources in the area, which serve as the limit for the rate charged, are now greater than the rates Western must charge to repay the costs of the Rio Grande Project on schedule. The Rio Grande Project power can now be marketed competitively.

Based on study analysis, rate increases are expected to be initiated in the near future on the Pacific Northwest-Pacific Southwest Intertie Project, the Parker-Davis Project, the Collbran Project, and the Fryingpan-Arkansas Project.

REPAYMENT

As of September 30, 1982, the investment to be repaid by Western's power systems totaled about $3.7 billion of which $1.3 billion has been repaid. Of the cumulative power revenues of $4.7 billion, $1.7 billion has been used for operation and maintenance expenses, $.7 billion for purchase power expenses, $1.0 billion for interest, and $1.3 billion has been used for repayment of investment in facilities and assistance to irrigation customers. The following table summarizes Western's repayment status by projects.

STATUS OF REPAYMENT AS OF SEPTEMBER 30, 1982
(Dollars hn Millions)

Project Power System	Cumulative Power Revenues	Cumulative Expense *	Total Investment to be Repaid by Power **	Investment Repaid to Date	Unpaid Balance of Investment
Boulder Canyon 17/	$ 471	$ 351	$ 139 18/	$ 120 1/	$ 52
Central Valley 16/	906	692	740 2/	214	526
Collbran	9	9	15	0 3/	15
Colorado River Basin (Navajo)	358	300 4/	228	58	170
Colorado River Storage 15/	717	561	677	156	521
Falcon-Amistad	15	11	7	4	3
Parker-Davis	294	189	165	105	60
Pick-Sloan Missouri Basin 5/	1,866	1,193	1,555	673	882
Pacific Northwest-Pacific Southwest Intertie 6/	18	18	47 7/	0	47
Provo River	2	1	1	1 8/	0 9/
Rio Grande	29	29	15 10/	0 11/	15
Fryingpan-Arkansas 12/	0	0	147 13/	0	147
TOTAL	$4,685	$3,354	$3,736 14/	$1,331 1/	$2,438

* Cumulative Expenses includes operation and maintenance, purchased power, interest, and other.

** Total Investment to be Repaid by Power includes repayment assistance, as appropriate, to nonpower investments; primarily irrigation investment.

Footnotes:

1/ Includes prepayment of $33 million for reserve for replacements. The $33 million will be reflected under "total investment to be repaid by power" when and if actually made.
2/ Includes $153 million of capitalized deferred expense.
3/ Repaid to date is $111,000, which was rounded to zero.
4/ Includes $4 million of revenues unapplied.
5/ Includes the four integrated projects.
6/ AC facilities only.
7/ Includes $10 million of capitalized deferred expense.
8/ Repaid to date is $609,000, which was rounded to $1 million.
9/ Unpaid balance is $461,000, which was rounded to zero.
10/ Includes $4 million of capitalized deferred expense.
11/ Repaid to date is $211,000, which was rounded to zero.
12/ New project, power revenues are anticipated in 1983.
13/ Includes $2 million of capitalized deferred expense.
14/ To date 34 percent of investment allocated to power has been repaid.
15/ Because of the time frame in which the CRSP status of repayment amounts are presented in the Budget, it is necessary that some of the data be estimated. The investment data for FY 1981 presented in the previous justifications included some estimated investments which did not materialize and were excluded in developing the data for FY 1982.
16/ Reduction of Central Valley investment from previous year is due to reduced irrigation aid requirements. Irrigation aid has been reduced because payments of the irrigators have been increased.
17/ Data for Boulder Canyon Project are through operating year which ended May 31, 1982.
18/ Reduced from previous year to exclude $25 million flood control investment which may be repaid from power revenues after 1987 should Congress so direct.

MARKETING PLAN STATUS

During the past year Western has continued work in the development of post-1989 marketing plans. These plans will be implemented upon the expiration of existing contracts. Efforts continued to coordinate the development of marketing plans for the Pick-Sloan Missouri Basin Program--Western Division and the CRSP.

A final power marketing plan for excess capacity from the Pick-Sloan Missouri Basin Program--Western Division was published in the Federal Register on August 30, 1982. Contracts are being developed to implement this marketing plan. An important feature of this plan is the integration of Federal capacity with non-Federal energy. We expect sales under this marketing plan to begin with the April 1983 billing period.

A power marketing plan for Federal power from the Pick-Sloan Missouri Basin Program--Western Division, the Fryingpan-Arkansas Project, and the CRSP is presently being developed to be effective beginning with the October 1989 billing period.

A plan for marketing an additional 102 MW which was made available as a result of settlement of a lawsuit between the city of Santa Clara, PGandE, and Western has been completed. The majority of the additional power went to new customers. However, a portion was allocated to existing customers which are involved in the development of renewable resources.

Development is continuing on the new marketing plan which will include resources from the Boulder Canyon and Parker-Davis Projects, plus surplus power from the Navajo Generating Station. The development of this plan has been delayed due to litigation with the States of Nevada and Arizona.

REVENUE AND ENERGY SALES

During FY 1982, Western marketed 36.1 billion kilowatthours of energy to over 530 wholesale power customers and had total revenues of $391.9 million. This total includes revenues from power sales, wheeling for others, and other miscellaneous power revenues. Our estimate for FY 1983 energy sales is 37.2 billion kilowatthours and for revenues is $453.6 million. For FY 1984, energy sales are estimated at 38.9 billion kilowatthours and revenues are estimated at $545.9 million.

The increase in energy sales from FY 1982 through FY 1984 is primarily reflected in the estimates for the Boulder Canyon and Parker-Davis Projects. These estimates for energy sales were a result of a hydrology study conducted by the Bureau of Reclamation. From this study more energy for sale was anticipated for FY 1983 and FY 1984.

Although energy sales have gradually increased, the most significant increases in FY 1983 and FY 1984 are in the estimated revenues. The increases are principally a result of rate increases for the CVP, Colorado River Basin Project (Navajo), and Pick-Sloan Missouri Basin Program. While the rate increase for Pick-Sloan Missouri Basin Program went into effect on August 1, 1982, CVP is anticipating stepped rate increases from May 25, 1983, through October 1, 1986, and the Colorado River Basin Project (Navajo) rate is set on an automatic adjustment formula which includes operation, maintenance, and fuel costs.

DISPUTES

Sacramento Municipal Utility District (SMUD). The litigation in the case of United States of America v. Sacramento Municipal Utility District involves the level of rates the city of Sacramento must pay for CVP power. The Ninth Circuit Court of Appeals has rejected the argument of the United States that the city's contract for the purchase of CVP power clearly allows Western to charge SMUD the same rate for power as charged to all other CVP customers. Settlement negotiations are currently in progress. If settlement is not attained, the case will go to trial on the issue of interpreting the meaning of the SMUD contract.

New Melones. On December 20, 1982, the Ninth Circuit Court of Appeals found that all conditions imposed by the State of California on the impoundment of water for the New Melones project were valid. One of the conditions prohibits the appropriation of water solely for power generation at New Melones. The Court noted that this condition does not mean that water which is already appropriated for consumptive or other purposes may not be used for power generation.

Project Dependable Capacity, CVP. The dispute with PGandE regarding Project Dependable Capacity (PDC) arose in 1978 after the 1976-77 drought. During the drought, PDC was declared to be 554 MW. The CVP's reservoirs refilled quickly after the drought and Western declared PDC to be at predrought levels. PGandE has disputed Western's declared levels and both Western and PGandE have been negotiating to resolve the dispute. The negotiations have been slowed by the lack of sufficient hydrology data and by other disputes between the parties regarding rates and sales of energy. The hydrology studies are now substantially complete, and Western has completed preliminary studies for alternative methods to determine PDC. The methodology used to derive PDC is currently being negotiated with PGandE. We have also resolved several of the other disagreements with PGandE and believe that the parties are on the path to resolving the PDC dispute without litigation.

Since the dispute arose, Western and PGandE have agreed in most years for Western to sell so called "capacity in excess of PDC." This capacity does not support customer loads and it does not avoid purchases of capacity from PGandE. However, it is sold to PGandE at the project rates and those sales bring in revenue which partially mitigates the losses and costs of the PDC disputes. At present, the sales are being made at an assumed PDC level of 554 MW.

When the levels of PDC are finally agreed upon, revenues from these sales will be adjusted to reflect the agreed-upon levels.

Northwest Import to California and CVP Energy Exchange Account with PGandE. On January 7, 1983, a Letter of Agreement was executed by PGandE and Western. This agreement provides for the settlement of a dispute which arose over Western's sale of surplus energy to the Northern California Power Agency (NCPA) during the 1982 summer season. PGandE claimed the sale violated certain PGandE/Western contracts and that the energy was required to be sold to PGandE for "Banking." NCPA claimed that such sales were consistent with those contracts and that "Banking" the energy with PGandE would violate the preference clause. Also at issue was Western's use of the Intertie to make such sales.

The settlement provides for approximately $10.5 million to be paid to PGandE by NCPA and Western, of which Western will pay about $9 million. Most of the payment made by Western will be netted against certain capacity sales which were claimed by Western but were disputed by PGandE.

The use and assignment of Western's 400-MW Intertie is specifically defined by the settlement. The settlement contains provisions under which Western can assign a portion of its interest to NCPA or other customers in the future.

Service charges on the Capacity Account, Energy Account No. 2, and the new Energy Exchange Account (EEA) were settled by the agreement. The first two of these charges have been under negotiation for over 2 years.

The major item in the settlement is the EEA. The purpose of the EEA is to exchange energy with PGandE during times of surplus (typically May-July) and receive like amounts in return during times when the CVP is short (the remainder of the year). The transaction does not involve a sale to PGandE or a repurchase, as no funds are transferred for the energy exchange. Thus, the preference issue involved in the sale of energy to the Energy Account No. 2 is avoided.

The benefit of the EEA is that Western can purchase energy when it is available at reasonable prices and, via the exchange, use the energy during time of scarcity when energy prices are higher.

The price for energy, when used, will be the purchase price paid by Western modified for short-term changes in PGandE's system energy costs. Western has been able, and expects to continue, to purchase most of the energy it needs at prices significantly below that of Energy Account No. 2, which in conjunction with the EEA, should reduce the need for purchase power funds.

STATUS OF WATER CONDITIONS

Based on the January 1983 "Water Supply Outlook for the Western United States," published by the Departments of Agriculture and Commerce, prospects are good for continuation of adequate to abundant water supplies this coming summer in the West's major river basins. Soil moisture conditions have been excellent, a good snowpack has been accumulating in the mountains, and except for northern California where flood control levels are being maintained, reservoir storages are above-average. These factors all indicate that spring and summer runoff will equal or exceed average conditions in most of Western's power marketing area. With good streamflow prospects and above-average reservoir storage, the outlook is favorable for adeqtate water supplies and above-average energy generation during 1983.

Although the 1983 water supply outlook is well above-average in the Sacramento, San Joaquin, and Trinity River Basins, most of the runoff occurring in the first quarter will have to be passed in order to maintain flood control levels in the major CVP reservoirs. If conditions turn dry, some reservoirs may not fill, and energy generation during the critical summer months may be low enough to force large power purchases. However, due to abundant snowpack in the high Sierra, expected runoff this spring is likely to be great enough to allow filling of the New Melones Reservoir.

The Missouri River Basin can generally expect near-average flows during water year 1983. The North and South Platte River Basins are forecast to have 85 to 95 percent of average runoff. The mainstem Missouri River and Yellowstone River are also forecast to have about 95 percent of average runoff. Current mainstem

Missouri River storage is about 60 million acre-feet compared to last year's storage of about 50 million acre-feet.

The water supply outlook for the Colorado River Basin also appears favorable. Streamflow forecasts in the upper Colorado and Green Rivers are slightly above-average, whereas the San Juan Basin is 115 percent of average. The combined storage of the 10 major reservoirs above Lake Powell is 6.6 million acre-feet, which is 84 percent of capacity and 150 percent of average. Lake Powell contains 22.6 million acre-feet, or 90 percent of capacity, and 2.5 million acre-feet more than last year at this time. The April-July inflow forecast to Lake Powell is 7.8 million acre-feet, or 112 percent of the 15-year average flow.

OIL CONSERVATION PROGRAM

Western's oil conservation program takes advantage of the flexibility of the large Federal reservoir system in our power marketing area. Surplus low-cost thermal energy is purchased during offpeak load periods to supply Western's customers; which allows water to be stored in Federal reservoirs for later use. Hydropower is then sold during onpeak load periods to customers who would otherwise use oil- or gas-fired generation. Western's continued success with this program has been based on the availability of offpeak coal-fired generation to couple with the Federal hydropower system.

Western experienced its most successful year to date with its oil conservation program during FY 1982. We anticipate continued successful results from this ongoing program during both FY 1983 and FY 1984 if currently projected above-average water conditions occur. For the period December 1972 through September 1982, over 53 million equivalent barrels of oil have been displaced through Western's oil conservation program. During fiscal years 1983 and 1984, our goal is to displace at least 5 million barrels of oil each year. Increased revenues to the U.S. Treasury associated with sales from this specific program have amounted to over $250 million. These revenues are in addition to those collected from normal power sales and have the effect of minimizing Western's firm power rate increases.

CONSERVATION AND RENEWABLE ENERGY

The FY 1984 budget provides a total of $1 million for customer Conservation and Renewable Energy (C&RE) Program activities. Western requires all firm power customers to submit a C&RE program plan within 1 year of signing a new contract. This past year, Western reviewed and approved approximately 300 customer C&RE program plans aimed at conservation and increased energy production from renewable resources.

Western's customer-oriented C&RE renewable resources activities included: the loan of over 100 anemometers to our customers who are actively gathering data for possible wind development sites, and the conduct of 16 workshops which provided direct technical assistance to more than 500 representatives of our customers.

Other C&RE accomplishments include: residential and renewable energy auditing workshops; irrigation pump testing workshops and equipment loans; heat detection equipment purchases, loans, and demonstrations; studies and analyses of conservation measures; renewable resources for Western facilities and customer applications (geothermal, solar, wind, and cogeneration) as well as in-house C&RE activity planning; training of Western staff; and improved communication interfaces with Federal and State C&RE agencies.

This concludes my summary of the Western Area Power Administration's FY 1984 budget request and program status.

EMERGENCY FUND

Senator McClure. Why are you proposing to change the appropriation language for the emergency fund?

Mr. McPhail. The $500,000 emergency fund we have proposed is the minimum amount to cover a large emergency. One of our large transformers, if it was hit by lightning, would cost up to a million dollars to replace.

That is the reason we have an emergency fund, to cover things that are not included in our operations and maintenance budget.

Senator McClure. Have you ever had a large transformer hit?

Mr. McPhail. Yes, we have, about 6 months ago. It is still out of service.

Senator McClure. And you haven't had the emergency fund, and you took care of that emergency without the emergency fund?

Mr. McPhail. Our current emergency fund limits expenditures to $500,000 annually. If emergency repair or replacement costs exceed the $500,000 limitation, then ongoing operations and maintenance funds are used. What you would do is defer other normal maintenance work items and use those dollars to cover emergencies.

Senator McClure. How does the proposed change in the language affect your flexibility in the use of the money?

Mr. McPhail. I'm not exactly sure what the language change is.

Senator McClure. Would you submit for the record what you intend to do by the change in language? We would like to know the reason for the change.

Mr. McPhail. I would be glad to.

[The information follows:]

Emergency Fund

A change is required in the method for financing the Western emergency fund from annual appropriations to funding emergencies from power revenues. This change would allow Western to replenish this fund during emergency conditions to provide the most timely, cost-effective repair of damaged electrical facilities and defray operating expenses to insure continuity of electrical service. Funds expended for emergencies would be replenished without having to seek supplemental appropriation authority in order to cover the emergency repair work when the initial $500,000 was exhausted.

This language was contained in the President's fiscal year 1983 budget request and included in H.R. 7145 and S. 3079 as reported by the House and Senate Appropriations Committees in the 97th Congress. However, the change was not included in the second continuing resolution which provided for our fiscal year 1983 appropriations.

Senator McClure. Your actual expenditures have historically been less than $500,000 a year.

Mr. McPhail. Yes, sir.

PERSONNEL REQUIREMENTS

Senator McClure. Now, your budget request includes an increase of 74 full-time equivalent positions. Why do you need these additional people?

Mr. McPhail. When the power marketing functions were transferred from the Bureau of Reclamation several years ago to the newly created Department of Energy, the OMB guidelines were if a person works 50 percent or more of his time in the power marketing business, that person and that position will transfer to the Department of Energy. If the person works less than 50 percent of his time, he stays in the Bureau of Reclamation. Through that split, as you might imagine, the agency that is transferring people protects itself. The result is we are short of positions.

Through the past several years, we have been able to add a few new positions here and there to come closer to having a staff that is adequate to take care of our business.

Senator McClure. When did that occur?

Mr. McPhail. The transfer?

Senator McClure. Yes.

Mr. McPhail. In 1977.

Senator McClure. So these 74 are an inheritance of something that happened 6 years ago?

Mr. McPhail. That's true.

Senator McClure. And you have been operating 6 years without them?

Mr. McPhail. We have been operating 6 years without them. We did a detailed manpower utilization study with the contractor, Touche-Ross Co. They analyzed our workload and how many people we had. They compared us to other utility operations and their determination was that our staffing level should be in the range of about 1,900 positions. At that time, we had about 1,200 positions.

So we have been able, each year, to add a few new positions to our organization, but we are still only up to 1,423 with the addition of these 74 positions.

ADDITIONAL PREPARED QUESTIONS

Senator McClure. I will submit several other questions, including questions from Senators Abdnor and Domenici, in writing for your response in writing if you would, please.

Mr. McPhail. Yes, sir.

Senator Huddleston. I have no questions.

Senator McClure. Thank you.

[The questions and answers follow:]

QUESTIONS SUBMITTED BY SENATOR HATFIELD

Status of Rifle-San Juan Transmission Line

Question: What is the current status of western Colorado (Rifle-San Juan) 345-kV transmission line?

Answer: Last year, we advised the committee that the Public Utilities Commission of Colorado had denied Colorado-Ute Electric Association a permit for construction of double-circuit 345-kV transmission facilities between Rifle, Colorado, and San Juan, New Mexico.

Subsequently, Colorado-Ute Electric Association, Public Service Company of Colorado, and Western reformulated the project. Colorado-Ute Electric Association and Public Service Company of Colorado have applied to the Public Utilities Commission for a permit to construct a single-circuit 345-kV line from Rifle to San Juan.

Currently, the Public Utilities Commission is in the process of holding hearings on Colorado-Ute's and Public Service Company's application. A decision from the Commission is not expected before this summer. A permit is needed from the Commission before construction can start on this line as a joint participation project.

Question: Financial participation has been reformulated and Western now intends to provide 50 percent of the total cost compared to 30 percent of the original project. Is this still a cost-effective undertaking for Western?

Answer: Plans for constructing a double-circuit 345-kV transmission system in western Colorado were modified in 1983 as a result of Colorado Ute's inability to obtain PUC approval for its participation. The plan before the PUC now is for a single-circuit 345-kV line. Western's participation remains cost effective. The costs per kilowatt of transmission capacity for Western's participation are about the same in the original plan as in the current plan.

Question: What is the projected payback period?

Answer: The FY 1981 power repayment study for the Colorado River Storage Project shows all power investment costs, including the cost of the western Colorado 345-kV transmission system, being paid back by 2013.

Federal Savings From Joint Participation Construction

Question: What has been the dollar saving to the Federal Government as a result of joint participation in the construction of needed transmission facilities?

Answer: Since 1976, Western has been involved in constructing three major transmission facilities under joint participation arrangements. Those facilities were the 345-kV Hayden-Ault Transmission Project, the 230-kV Miles City-New Underwood Project, and the Miles City 200-MW Converter Station. Had Western constructed these facilities without joint participation arrangements, the cost to the Government would have been $92,974,000. However, with the joint participation arrangements, Western's share of the project costs were $59,890,000. This represents a savings to the Federal Government of $33,084,000 or approximately 36 percent.

Emergency Fund

Question: Why are you requesting $500,000 for the Emergency Fund when expenditures have historically been less?

Answer: We believe the $500,000 is a minimum amount necessary to respond to emergency repair work in the majority of our situations, considering the wide range of storm incidents that could occur over our extensive Federal transmission system. Although the majority of emergency repair jobs will cost less than $500,000, Western is budgeting that amount because:

- A combination of two or more emergencies involving a large electrical transformer or circuit breaker replacement would quickly result in expenditures exceeding $500,000, and

- There are instances, such as extensive transmission line damage due to tornadoes, ice storms, forest fires, etc., where the cost of a few miles of repairs would exceed the $500,000 budget.

Personnel Requirements

Question: Your budget request includes an increase of 74 full-time equivalent positions. How many additional full-time permanent positions are being requested?

Answer: All of the requested 74 additional full-time equivalent positions are permanent positions. We are not requesting any increase in other than full-time permanent positions.

Question: What is the budgetary impact of adding these people?

Answer: The annual salary requirements of these additional 74 full-time permanent positions is $1.46 million. The total budgetary impact of adding these positions, including benefits and related costs, is $2.1 million.

Question: Conversely, what would be the impact on system reliability and operation if they were not allowed?

Answer: Western's present staffing level enables us to maintain operations and service, but not without a degree of risk regarding system reliability and capability to meet present and anticipated future customer load requirements. Without the additional 74 positions, we would assume a reactive rather than a proactive approach to accomplishing our overall work objectives. We believe these additional positions to be essential for Western to maintain its ongoing operation and maintenance activities at an acceptable level of service to our customers. Specifically, the impact on not receiving the additional positions will result in:

'Inability to increase system reliability through additional scheduled preventive maintenance activities and diagnostic testing;

'Loss of revenue to the U.S. because of delays in revising and implementing new rate structures;

'Inability to reduce the backlog of vendor and contractor payments;

'Inability to reduce unsafe or hazardous worksites;

'Delays in implementing new marketing plans, resulting in possible inability to place additional resources under contract;

'Potential for millions of dollars in lost revenue because of underestimating of water availability;

'The addition of transmission facilities to the existing system without commensurate additions of personnel to operate the system would cause severe and unsafe operating practices as well as lead to possible major power outages in major cities such as Denver, Phoenix, or Sacramento. This could affect millions of people and cost millions of dollars;

'Delays in completing projects, resulting in failure to meet power contract commitments resulting in loss of revenue;

'Increased possibility of inservice failures of vital substation equipment (such as power circuit beakers and power transformers) and increased hazard to maintenance personnel due to inadequate frequency of substation equipment checks.

Question: Provide for the record a detailed breakout of the type of position, grade level, salary, and a short narrative of why each position is needed.

Answer: (The material to be provided follows:)

Position Title	Number of Positions	Grade	Annual Salary Requirement
System Maintenance			
Electrical Engineer	2	GS-9	$40,512
Electronic Equipment Mechanic	5	WB	76,300
Electrician	8	WB	115,200
Plant Mechanic	1	WB	13,600
Meter and Relay Mechanic	3	WB	45,780
Lineman	6	WB	86,400
Electronic Technician	1	WB	15,260

These positions are required to: operate and maintain the new AC/DC/AC converter station at Miles City, Montana; to operate, maintain, and recondition additional facilities recently transferred from the Bureau of Reclamation (BuRec); to increase preventive maintenance through increased line patrols, relay testing, and calibration; to increase substation equipment maintenance and periodic diagnostic testing for newly energized facilities associated with the Colorado River Storage Project (CRSP); and to perform preventive maintenance on newly energized facilities in the Phoenix District and the Loveland-Fort Collins Area.

System Operations

System Dispatcher	4	GS-11	98,032
Computer Specialist	3	GS-11	73,524

These positions are required to: perform system dispatching duties associated with transferred facilities from the BuRec and with newly energized facilities associated with CRSP, and to install and maintain a new major supervisory control and data acquisition system at the Loveland-Fort Collins Area Office and the Montrose District Office.

Power Marketing

Public Utilities Specialist	7	GS-7	115,913
Energy Resource Specialist	2	GS-9	40,512

These positions are required to: develop river basin mid- and long-range hydrology forecasts and operating plans; develop, adjust, and implement power rates and new rate proposals; develop marketing plans for the post-1985 period; conduct direct solar, geothermal, wind, and small-scale hydro studies; prepare new prototype contracts; and develop new rate methodologies and marketing criteria.

Position Title	Number of Positions	Grade	Annual Salary Requirement
Engineering and Construction			
Realty Specialist	4	GS-9	81,024
Electrical Engineer	8	GS-11	196,064
General Engineer	2	GS-9	40,512
Civil Engineer	1	GS-11	24,508
Electronic Engineer	1	GS-12	29,374

These positions are required to: develop and maintain power system model programs; perform additional construction inspection, laboratory testing, and field survey workload related to system improvements, upgrades, and security additions; perform studies of financial feasibility of all proposed system facilities using econometric methods and models, and demographic projections; develop technical and economic data bases for planning, estimating, scheduling, and controlling facilities development; provide additional contract administration support for architectural-engineering contracts; and to perform system planning, lands and rights work, and civil and electrical design and specifications work for proposed AC/DC/AC interties.

Program Support

Computer Specialist	1	GS-11	$24,508
Safety Specialist	1	GS-11	24,508
Environmental Specialist	2	GS-12	58,748
Accounting Technician	3	GS-5	40,107
Cost Accountant	2	GS-11	49,016
Program Analyst	2	GS-12	58,748
Supply Technician	1	GS-5	13,369
Contract Specialist	2	GS-12	58,748
Personnel Management Specialist	1	GS-12	29,374
Warehouseman	1	WB	10,250

These positions are required to: avoid delays in processing financial transactions; provide additional contracting, contract management, and procurement support to the engineering and construction program; conduct environmental evaluations associated with proposed agency actions; provide additional support for the increasing workload in ADP systems development and maintenance; develop and maintain Plant Accounting System; improve current activities in work measurement, Annual Operating Plan, internal controls, and special studies relating to financial management and fiscal planning; implement Western's Warehouse Inventory Management System in the Sacramento Area; provide increased capability to comply with the Occupational Safety and Health Administration Act, Executive Order 12196, and current Department of Labor standards, and evaluate contractor performance and safety training programs; and to conduct personnel staffing studies and enhance personnel staffing and classification activities.

TOTAL	74		$1,459,891

Fixed-Wing Aircraft

Question: Explain your need for a fixed-wing aircraft.

Answer: Western has numerous operations in sparsely populated areas which are only served by limited public transportation. As a result, a considerable amount of nonproductive time is expended by using indirect commercial air and ground transportation to reach remote job sites. It is not unusual for a person to expend 2 full workdays to accomplish a half-day's work. Use of Western-owned and operated aircraft allows maximum flexibility in scheduling staff travel and reducing travel expenses. This plane will be used to rapidly dispatch crews and equipment to trouble spots for repairs or damage assessment, thereby shortening the duration of power outages.

The estimated cost for a fixed-wing aircraft to meet Western's needs is approximately $1.5 million.

Reduction in Budget Authority

Question: Does the reduction in budget authority to $149 million in FY 1983 present any problems?

Answer: Western's total FY 1983 program of $217.2 million consists of appropriations of $150.1 million plus $67.1 million of FY 1982 carryover. These amounts are in accordance with the intent of the FY 1983 Second Continuing Resolution, and will provide Western with sufficient monies to meet its planned goals and objectives in FY 1983.

System Operations and Maintenance

Question: Please explain the need for a $20.1 million increase in the System Operations and Maintenance request for FY 1984.

Answer: This increase is to cover additional costs to operate, maintain, and recondition additional power facilities transferred from the Bureau of Reclamation; to provide substation maintenance and periodic diagnostic testing for the newly energized facilities; to replace original electrical equipment as it approaches the end of its useful life; to increase preventive maintenance through increased line patrols, relay testing, calibration, and replacement of transmission line structures; to install and maintain a major power dispatching control system; and to provide additional contract support for meeting an increasing workload in ADP system development and maintenance, conducting environmental evaluations, and to support the construction program.

Purchase Power and Wheeling

Question: On what hydrological assumptions is the $68 million request for purchase power and wheeling based?

Answer: Western's basic requirement to purchase energy stems from the fact that the determination of the amount of energy available for marketing from hydropower projects is based on an "average" water year. During "less-than-average" water years it is necessary to purchase more energy to meet Western's contractual commitments to its power customers.

Question: Do you believe this to be appropriate?

Answer: We believe this is appropriate as that is the amount of energy which we are obligated to supply under our firm power contracts.

Colorado River Basin Marketing Fund

Question: What is the reason for the $8.1 million increase requested for the Colorado River Basin Marketing Fund?

Answer: The $8.1 million increase is required to: acquire and install a supervisory control and automatic data acquisition system at Montrose, Colorado, which will replace an obsolete and inadequate power distribution control system; to provide for an increase in contract progress payments associated with upgrading the Fort Peck-Havre 116-kV transmission line; and to meet increased costs for scheduled annual maintenance of the transmission system as well as administrative expenses.

Status of Construction Activities

Question: What is the current status of the Western Colorado 345-kV Transmission Project?

Answer: There are three 345-kV transmission lines in Western's western Colorado program. The upgrade of Western's existing 98-mile Craig-Rifle line from 230 kV to 345 kV, the construction of the 275-mile Rifle-San Juan 345-kV line, and the upgrade of the 8-mile Four Corners-Shiprock 230-kV line to 345 kV.

Western awarded construction contracts of $9.7 million in the summer of 1982, and $1.4 million in the fall of 1982, respectively for upgrading the existing Craig-Rifle and Shiprock-Four Corners lines.

However, there have been delays associated with the Rifle-San Juan line stemming from a denial by the Colorado Public Utilities Commission (PUC) to permit constuction of a double-circuit transmission facility between those two points. The project has subsequently been reformulated and the principal parties involved have applied to the PUC for a permit to construct a single-circuit line between Rifle and San Juan.

The PUC held hearings January 17-19, 1983, on the reformulated Rifle-San Juan 345-kV, single-circuit transmission line; and further hearings are scheduled for March 7, 1983. A decision from the PUC is not expected until this summer.

Question: What is the current status of the Miles City a.c.-d.c.-a.c. Converter Station?

Answer: A turnkey contract in the amount of $27,995,000 was awarded to the General Electric Corporation on August 16, 1982. Design is now underway, with contract completion scheduled for February 1, 1985. The site grading and preparation for the project has been completed. Construction work at the site will commence in the spring of 1983, with the major items of electrical equipment scheduled to be delivered to the site during the 1983-84 winter period.

Question: What is the current status of the Great Falls-Conrad Transmission Line?

Answer: A preferred transmission corridor has been selected, and the project's draft environmental impact statement is scheduled to be issued in April 1983. Preliminary survey work will also begin in April. Construction is scheduled to begin in August 1984 with completion in December 1985.

Question: What is the current status of the Coolidge-Saguaro 115-kV Transmission Line?

Answer: Environmental investigations and project designs have been completed. A construction contract is scheduled to be awarded in April 1983 with completion in March 1984.

Construction Schedule

Question: Please explain the reason for the large amounts in the "remaining balance" column of the construction schedule on page 173 of the DOE Congressional Budget Request.

Answer: A significant portion of the amount in "Remaining Balance" is associated with the DC intertie facilities between the Dalles, Oregon, and Mead Substation, in southern Nevada. The Celilo-Mead portion of the DC intertie will undergo detailed study during FY 1983, and the projected status will be revised accordingly. Western is conducting studies for increasing the intertie capacity in cooperation with the Bonneville Power Administration.

The remaining balance of funds programmed are for transmission facilities associated with future proposed electric generation. Many of these features are in early planning and development stages and will take a number of years to mature.

DC Tie Program

Question: The dc tie program was previously portrayed consisting of 3 separate ties (one of which is under construction (Miles City)). Why is there no new start for one at either Fort Peck, Montana, or Sidney, Nebraska, in the FY 1984 request?

Answer: The Fort Peck AC-DC-AC tie has been deferred beyond the FY 1988 period and removed from the FY 1984 budget submittal. The near-term needs for east-west power transfers at Fort Peck can be satisfied by the switching of hydroelectric generating units from the east-to-west system or vice versa.

The AC-DC-AC tie at Sidney is presently in the planning and negotiation stages with the various affected utilities. Western has a total of $13.6 million budgeted for the Sidney tie through FY 1987, assuming that we would have 30 percent participation in a 400-MW tie. An additional $30.6 million is estimated to be committed through Federal and non-Federal participation.

The present estimate for a 400-MW AC-DC-AC tie at Sidney, Nebraska, is about $44.2 million. The tie is presently scheduled to be in service the first quarter of FY 1988, but it would be desirable to accelerate this schedule because of the opportunities this tie offers.

Pacific Northwest-Pacific Southwest Intertie

Question: What has Western done to implement the Committee's direction to proceed with work on the second DC Pacific Northwest-Pacific Southwest Intertie transmission line?

Answer: Western is involved in a joint participation DC project between Mead Substation and the Phoenix area as part of the intertie project. The arrangements for the development portion of the Mead-Phoenix 500-kV DC line were signed by the participants in May 1982. The development portion of the agreements will provide for alignment and design studies and completion of environmental work. At the end of the development phase scheduled for mid-1984, each participant, including Western, will have the option to continue or to decline further involvement in the project. If Western elects to continue after the development stage, it will enter into a transmission service contract with the Southern California Public Power Authority to pay its share of debt service and operation and maintenance costs.

Additionally, Western, in cooperation with the Bonneville Power Administration is continuing studies designed to determine the interest exhibited by electrical utilities in both the Pacific Northwest and Pacific Southwest in constructing DC intertie facilities between the Dalles, Oregon, and Mead Substation in southern Nevada.

Repayment Status

Question: Please submit for the record Western's repayment status by project as of the end of FY 1982.

Answer: A chart illustrating Western's repayment status through FY 1982 follows below:

STATUS OF REPAYMENT AS OF SEPTEMBER 30, 1982
(Dollars in Millions)

Project Power System	Cumulative Power Revenues	Cumulative Expenses *	Total Investment to be Repaid by Power **	Investment Repaid to Date	Unpaid Balance of Investment
Boulder Canyon[17]	$ 471	$ 351	$ 139[18]	$ 120[1]	$ 52
Central Valley[16]	906	692	740[2]	214	526
Collbran	9	9	15	0[3]	15
Colorado River Basin (Navajo)	358	300[4]	228	58	170
Colorado River Storage[15]	717	561	677	156	521
Falcon-Amistad	15	11	7	4	3
Parker-Davis	294	189	165	105	60
Pick-Sloan Missouri Basin[5]	1,866	1,193	1,555	673	882
Pacific Northwest-Pacific Southwest Intertie[6]	18	18	47[7]	0	47
Provo River	2	1	1	1[8]	0[9]
Rio Grande	29	29	15[10]	0[11]	15
Fryingpan-Arkansas[12]	0	0	147[13]	0	147
TOTAL	$4,685	$3,354	$3,736[14]	$1,331[1]	$2,438

* Cumulative Expenses includes operation and maintenance, purchased power, interest, and other.

** Total Investment to be Repaid by Power includes repayment assistance, as appropriate, to nonpower investments; primarily irrigation investment.

Footnotes:

1/ Includes prepayment of $33 million for reserve for replacements. The $33 million will be reflected under "total investment to be repaid by power" when and if actually made.
2/ Includes $153 million of capitalized deferred expense.
3/ Repaid to date is $111,000, which was rounded to zero.
4/ Includes $4 million of revenues unapplied.
5/ Includes the four integrated projects.
6/ AC facilities only.
7/ Includes $10 million of capitalized deferred expense.
8/ Repaid to date is $609,000, which was rounded to $1 million.
9/ Unpaid balance is $461,000, which was rounded to zero.

10/ Includes $4 million of capitalized deferred expense.

11/ Repaid to date is $211,000, which was rounded to zero.

12/ New project, power revenues are anticipated in 1983.

13/ Includes $2 million of capitalized deferred expense.

14/ To date 34 percent of investment allocated to power has been repaid.

15/ Because of the time frame in which the CRSP status of repayment amounts are presented in the Budget, it is necessary that some of the data be estimated. The investment data for FY 1981 presented in the previous justifications included some estimated investments which did not materialize and were excluded in developing the data for FY 1982.

16/ Reduction of Central Valley investment from previous year is due to reduced irrigation aid requirements. Irrigation aid has been reduced because payments of the irrigators have been increased.

17/ Data for Boulder Canyon Project are through operating year which ended May 31, 1982.

18/ Reduced from previous year to exclude $25 million flood control investment which may be repaid from power revenues after 1987 should Congress so direct.

Central Valley and Rio Grande Project Repayment

Question: What has Western done to improve the repayment of the CVP and Rio Grande Projects?

Answer: For the Central Valley Project, Western has recently completed its activities leading to a rate increase which will become effective May 25, 1983. Actually, instead of one increase it is a series of increases embodied in one rate schedule. The initial increase in May 1983 will increase the composite yield from the present 9.76 mills per kWh to 16.89 mills per kWh. Subsequent increases will culminate in a composite yield of 39.63 mills per kWh beginning in October 1986. Based on present conditions, these rates will be adequate to meet repayment requirements.

For the Rio Grande Project, Western placed the first step of a two-step increase into effect in September 1982, and the second step will go into effect in September 1983. With the second step, the composite yield will increase from the previous 16 mills per kWh to 27 mills per kWh, which our studies have indicated would be adequate to meet repayment requirements. Because this project is so near the end of its repayment period, we will be carefully monitoring its repayment progress and will adjust the rates as necessary.

QUESTIONS SUBMITTED BY SENATOR ABDNOR

Presidential Budget Request

Question: How does Western fare in the President's budget request for FY 1984? Are there projects which you could be in a position to accelerate if Congress passes a jobs bill?

Answer: Western's FY 1984 budget request is $220.1 million, an increase of $2.9 million above the total funds available for FY 1983. This request is essentially for a "no new thrust" budget and provides for continuing ongoing work.

We have several projects that can be accelerated which have an estimated total cost of $60 million. This work would consist of constructing the Sidney DC tie in Nebraska, rehabilitating the Gering-Archer 115-kV transmission line in Wyoming/Nebraska, and acquiring various electrical transformers, power circuit breakers, and conductors for our power systems.

Pick-Sloan Missouri Basin Program Power Allocations

Question: Would you provide for the record, please, a listing on a state-by-state basis of Pick-Sloan Missouri Basin power allocations for the last 5 years?

Answer: Pick-Sloan Missouri Basin power allocations were the same for 4 of the last 5 years, but were changed in January 1982. The state-by-state breakdown is as follows.

(The material provided for the record follows:)

SUMMARY CONTRACT RATE OF DELIVERY (CROD)

	FIRM CROD			
	PRIOR TO JANUARY 1982		SINCE JANUARY 1982	
	WINTER KW	SUMMER KW	WINTER KW	SUMMER KW
FIRM				
Iowa	230,271	236,471	234,340	234,201
Minnesota	387,504	385,382	393,413	388,161
Montana	143,725	108,745	146,953	110,775
Nebraska	227,222	283,932	254,387	310,238
North Dakota	222,862	160,445	220,538	156,473
South Dakota	364,153	354,178	366,509	356,800
Subtotal - Firm	1,575,737	1,529,153	1,616,140	1,556,648
IRRIGATION				
Montana		16,160		15,860
Nebraska		1,090		1,090
North Dakota		1,735		1,935
Subtotal - Irrigation		18,985		18,885
Total - Firm and Irrigation		1,548,138		1,575,533

SUMMARY CONTRACT RATE OF DELIVERY (CROD)

	FIRM CROD			
	PRIOR TO JANUARY 1982		SINCE JANUARY 1982	
	WINTER KW	SUMMER KW	WINTER KW	SUMMER KW
SEASONAL FIRM				
Nebraska		75,000		75,000
Total - With Seasonal Firm		1,623,138		1,650,533
SEASONAL PEAKING				
Nebraska	95,000	375,000	95,000	375,000
North Dakota	280,000		280,000	
Subtotal - Seasonal Peaking	375,000	375,000	375,000	375,000
GRAND TOTAL - WITH SEASONAL PEAKING	1,950,737	1,998,138	1,991,140	2,025,533

Pick-Sloan Missouri Basin Program Power Allocations

Question: Could you also provide a hypothetical state-by-state power allocation if all projects envisioned in the Flood Control Act of 1944 were developed and in operation today?

Answer: The determination of how much power and energy would be available if all those projects were in operation today would require considerable time. Generally, there would be less power and energy available for allocation because of water depletions and project water pumping requirements. Allocations to each state, for hypothetical purposes, would be reduced proportionate to the reduction in power and energy available.

Question: What is the current rate for irrigation pumping power and for all Pick-Sloan Missouri Basin power?

Answer: The rate for irrigation pumping power is established by the Bureau of Rdclamation and is presently 2.5 mills per kilowatthour. The rate for all other Pick-Sloan Missouri Basin power is a composite 6.1 mills per kilowatthour for firm power, $1.35 per kilowatt per month for Eastern Division peaking power, and $1.43 per kilowatt per month for Western Division peaking power.

Question: What is a typical comparable rate for non-Federal baseload power and non-Federal peaking power?

Answer: The composite rate for wholesale firm power from non-Federal sources starts at about 41 mills per kilowatthour and increases from there up to nearly 60 mills per kilowatthour, based on limited information we have available. We are not aware of peaking power rates for non-Federal resources, but the capacity component of the firm power rate seems to range from near $11 per kilowatt per month up to about $17.50 per kilowatt per month.

Missouri Basin Program

Question: What is the status of any challenge to the "ultimate development concept" in the Missouri Basin Program or to your current rate structure?

Answer: Three of the Western Division customers have filed a Petition to Intervene, with the Federal Energy Regulatory Commission. Another challenge to this concept, however, is the disapproval by FERC of the Colorado River Storage Project rate due to their objection to the concept of including all authorized future participating projects unless a reasonable expectation of their construction can be demonstrated. We would anticipate that FERC will also question the Missouri Basin Program rate for similar reasons.

Question: How much irrigation investment in South Dakota is envisioned in your rate structure by the year 2000?

Answer: Total irrigation investment envisioned by the year 2000 was $54,624,000, and of this amount $38,612,000 would be paid by power revenues-irrigation aid.

However, since the rate structure was established, changes in irrigation investment have occurred so that no irrigation investment in South Dakota by the year 2000 is presently contemplated.

Pay Inequities in Dispatcher Occupations

Question: As you are probably aware, the pay inequities in dispatcher occupations within the Western Area Power Administration (Western) continue to be a matter of serious concern to me. I know that your office has referred this matter to the Office of Personnel Management (OPM). Could you address this situation and relate what future action might be taken to assist these employees?

Answer: I appreciate the opportunity to comment on this. Our studies shown that there is a $5,000 to $6,000 per year variance in salaries between Western's dispatchers and those in the utility industry. We did go to the OPM in late December 1980 for a special rate for these employees, but we were turned down in August 1981. This is a very serious matter because excessive turnover in this group directly threatens our ability to maintain the delivery of power to our customers. We continue to search for ways to solve the problem but the Federal personnel system offers very little hope. We feel that special legislation may be the only solution.

QUESTION SUBMITTED BY SENATOR DOMENICI

Colorado River Storage Project

Question:. On page 243 of Western's FY 1984 budget materials there is discussion of Western's efforts to develop new marketing criteria for several of its projects, but no mention is made of the Colorado River Storage Project (CRSP). It is understood that current CRSP marketing criteria requires that new criteria for after 1989 (when all CRSP contracts are to expire) be developed 7 years in advance. What is the status of Western's efforts in this regard and when will the post-1989 criteria be available?

Answer: Western is in the process of developing a post-1989 marketing plan for the CRSP. On February 4, 1983, a request for applicant profile data was published in the Federal Register. We expect to publish a proposed criteria by mid-summer 1983, and complete the plan by the fall of 1984.

SOUTHWESTERN POWER ADMINISTRATION

STATEMENT OF RICHARD B. RISK, JR., ADMINISTRATOR

Mr. TRIBBLE. Mr. Risk is next.

Senator McCLURE. Mr. Risk, are you next? It has just been suggested that you son might like to ask some questions of his dad. [Laughter.]

Mr. RISK. That would be it for the day. [Laughter.]

Mr. Chairman, it is my pleasure to again appear before this committee.

With your permission, I would like to submit my statement in the record and summarize.

Senator McCLURE. It will be placed in the record in full.

[The statement follows:]

STATEMENT OF RICHARD B. RISK, JR.

Mr. Chairman and Members of the Committee:

It is a pleasure to appear before you today to discuss the need for funds to carry out Southwestern Power Administration's programs during Fiscal Years 1983 and 1984. The budget request for Southwestern's major activities are:

	1983 Resolution	1984 Request
Operation and Maintenance	$ 9,070,000	$ 9,800,000
Purchase Power and Wheeling	7,156,000	22,729,000
Construction	4,530,000	3,700,000
Total	$20,756,000	$36,229,000

The requested FY 1984 appropriation represents an increase of $15,573,000 over the funds provided by the Continuing Resolution of FY 1983. This increase primarily represents a technical adjustment to the purchase power and wheeling activity rather than a real increase in the program. The low level of new budget authority in FY 1983 for the purchase power and wheeling activity is partially offset by carryover funds available because of good rainfall during FY 1982 which conserved funds.

MISSION

The Southwestern Power Administration (SWPA) carries out the responsibilities assigned to the Secretary of Energy pursuant to Section 5 of the Flood Control Act of 1944, and Section 302 of the Department of Energy Organization Act. These Acts authorize the distribution and sale of power and energy produced at 23 hydroelectric projects constructed and under construction by the Corps of Engineers in the states of Arkansas, Missouri, Oklahoma, and Texas, with a total installed capacity of 2,147,800 kW. Southwestern markets this power and energy in the above four states plus Kansas and Louisiana. Twenty-one of these 23 projects have been completed and are in operation. Two projects in Missouri are under construction.

Southwestern's mission is to market this power and to encourage the most widespread use at the lowest possible rates to consumers consistent with sound business principles. This has resulted in the construction of a transmission system which now consists of approximately 1,660 miles of high-voltage transmission lines, including 33 substations and switching stations interconnecting the existing hydroelectric generating plants and neighboring utilities.

The mission also requires that preference in the sale of power and energy shall be given to public bodies and cooperatives at rates sufficient to recover the cost (including amortization) of producing and transmitting the hydroelectric power.

It is estimated in our latest Repayment Study that in FY 1984 average gross revenue will be $89.5 million. Cash received and deposited in the U. S. Treasury after net billing will be approximately $87 million, which more than doubles the requested appropriation.

BUDGETED PROGRAMS

The request for $9,800,000 for Operation and Maintenance will provide funds to conduct the marketing activity of negotiating and administering power sales contracts; establishment and review of rate levels; dispatching of power to the customers; the maintenance of substations, switching stations, communications facilities, and transmission lines; and the direction and support of the organization. This amount represents a $730,000 increase from the prior year.

Of this increase, $143,000 is for a planned negotiated pay raise for wage hour employees represented by the International Brotherhood of Electrical Workers; $178,000 for overtime and travel; $39,000 is for an increase in office and space rental; $189,000 is for increases in communications, utilities, supplies, and materials; and $181,000 is to perform system line maintenance by contracts to meet the escalating maintenance requirements of a system of which one-third exceeds 34 years of age, with a normal service life of 35 years. As the remaining transmission system continues to age, maintenance workload continues to increase.

This aging system has required that the integrity of each wood structure in the system be tested under sonic inspection which was performed by a contract service. Over 1,000 poles were identified as needing replacement through 1985. Improvements are being realized with pole change outs increasing 26 percent between 1980 and 1982. The goal for 1983 will be an additional 10 percent boost in productivity. Similar progress is also being made in changing cross arms which increased 23 percent during the same time period.

As a member of the Southwest Power Pool, we have an obligation to meet specified control performance criteria. In order to improve our performance, we have installed new Automatic Generation Control and Supervisory Control and Data Acquisition Equipment (AGC/SCADA) in 1982 as an initial step in improving operation of the power generation and transmission system. Related to these systems, the entire communication system which provides vital information to the AGC/SCADA System is being reviewed during 1983 with required improvements planned for accomplishment in 1984

Like improvements are being brought to our power contracting area. Substantial effort is being made to assist the 42 municipals in Kansas and Louisiana to join their municipal authority in order to facilitate the negotiation and contract administration process. The uniting together would also benefit them in working out their transmission wheeling arrangements for the Federal Power.

The request for $22,729,000 for Purchase Power and Wheeling is $15,573,000 more than received in FY 1983. This increase at first appears large, but in fact, is a technical adjustment over the amount provided by the Continuing Resolution Appropriation for FY 1983. The criteria used for determining a budgetary level is the amount of thermal energy purchases necessary to cover critical year reservoir inflow conditions for several months of the budget year, plus funding for contractual commitments for transmission and energy supply. The requested amount covers 3-1/2 months of critical year inflow conditions. The low amount received in FY 1983 resulting from the amount reduced by the Continuing Resolution for 1983 is partially being covered by $9 million carryover of funds which occurred after very heavy rainfall conditions in FY 1982.

Adequate funding of our thermal energy purchasing needs is very critical, considering the vast fluctuations of rainfall which occur in the arid Southwest and the fact that the Emergency Fund is not available for power purchases.

It is important to add that Southwestern began taking action in 1970 to convert all expiring contracts from high energy commitments to low energy 1200 hour commitments, thus reducing future Purchase Power and Wheeling budgets. The effects of this contractual action will be noticeable in future budget years.

The estimate of $3,700,000 for the Construction program represents a decrease of $830,000 from the FY 1983 appropriation. This decrease and the entire request represents a collection of many small system modifications necessary to maintain the reliability and the adequacy of the Government's portion of the area electric utility grid, with no new starts.

A number of SWPA customers on the east end of the SWPA transmission system, Southeast Missouri and Northeast Arkansas, are in a position where transmission system improvements are going to have to be made in the next few years. Studies are planned with the utilities in that area to determine what the best engineering solution is to meet these future transmission system requirements.

FORTY YEARS OF CONTRIBUTIONS

I have been Administrator since November 1, 1981, or a total of 16 months. On September 1, of this year, Southwestern Power will be celebrating 40 years of contributions from supplying low cost electric energy to the Southwest United States. In many ways its contributions have been significant. It has played a major role side by side with the Corps of Engineers in developing the natural resources of three major river basins. These resources not only include hydropower but also flood control, municipal and industrial water use, navigation as well as the major economic benefits associated with recreation.

During this period the Congress has made $1.2 billion in appropriations available to Southwestern and the power producing functions of the Corps of Engineers. Receipts deposited in the Treasury for the same time were $685 million or a direct return of 57 percent.

The 94 billion kilowatt hours of energy generated from this low cost hydro and distributed through the transmission grid played a major role in the economic development of rural and small town America. In future years hydroelectric generation will average 5 billion kilowatt hours each year. There is no doubt that Southwestern greatly assisted the new Rural Electric Cooperatives get started and now they are strong viable businesses in all six states.

This energy certainly made life easier for the hundreds of thousands of families in the agriculture industry which provided the ability and technology to feed this country through three major wars and now to the point where we are out producing our ability to consume and sell on the world market. We are now as a nation benefiting from this renewable energy in terms of saving precious oil which would be consumed in giant thermal furnaces.

There is no doubt Southwestern will have a lot to be proud of.

CHANGES

Over the years the development of new low storage, low energy projects, combined with additional demands for municipal and industrial water use left Southwestern with long term energy contracts in excess of system capability. The combination of the need to purchase high cost thermal energy and sales at noncompensatory rate levels caused Southwestern to fall behind in meeting its repayment obligations. To date Southwestern has repaid $30 million on $725 million investment in service. This low amount is certainly below that where Southwestern should be. Since 1970 Southwestern has been striving to ensure that it could fully meet its repayment obligations. Contracts were renegotiated to lower the quantities of energy sold from full load factor of 2400 and 1800 hour sales to 1200 hours of generation. It made selective rate adjustments to increase the financial return of individual contracts and finally in 1979 implemented a major system wide rate increase of 33 percent to place it back on a sounder financial track.

In the past year we have changed the standard contract term from 20 years to 10 years. In fact, some earlier contracts were written for periods in excess of 30 years and in one instance 40 years and this lack of flexibility has been to our detriment. This shorter term will assure us that should conditions in the industry change, as they did in the oil embargo of 1973, the government will have an early opportunity to adjust its obligations.

We will continue our ongoing efforts of reviewing our policies to meet the program needs of the next decade. As part of this ongoing review, I have recently completed a new system rate study to determine if our rates are compensatory. As a result of this study we have filed this month with the DOE a request for new and higher system rates in the order of a 38 percent increase or $25 million more each year. We expect the new rates to go into effect October 1, 1983.

In addition, a study of the contractual rate for the Sam Rayburn Hydroelectric project in Texas has also revealed a need for an increase of 25.2 percent or $349,000 in addition to the present contractual rate amount of $1,388,000. The formal public participation process has been completed and filing of the increase will be accomplished soon. The rate is uncontested and is expected to be in effect June 1, 1983.

PROGRESS REPORT

Recognizing the Committee's responsibility, it is important to acknowledge that since last year's hearings it has been a good year at Southwestern Power. On sales of $65.7 million we netted $14.2 million which was the amount that we needed to meet our amortization obligations for the year. This is substantially different from the previous year when we were short $16.8 million for interest payments with nothing available for amortization. The $30 million turnaround was possible because of near critical water conditions occurring in FY 1981 and favorable conditions last year. It also demonstrates how financially sensitive the system is to widely varying inflow conditions.

Last year Southwestern reported to this Committee settlement terms were being discussed that would end a contract dispute with the Associated Electric Cooperative, Inc. of Missouri, outstanding since 1970. I believe I stated that coming to a negotiated settlement "will be difficult." This year we are pleased to state that a tentative settlement agreement between parties has been reached on the $28 million in dispute for the period from 1970 to April 1981. This settlement was reached by specific language which has been submitted to the Department of Energy for concurrence and submission to the Justice Department and the court.

FAVORABLE LITIGATION

Another positive action was a very favorable decision in the Fifth Circuit Court of Appeals which reversed a lower court decision in favor of Tex-La Electric Cooperative, Inc. and Northeast Texas Electric Cooperative. The reversal by the Fifth Circuit in Southwestern's favor came on November 26, 1982, completely affirming Southwestern's and the Assistant Secretary's interim rate making authority and actions taken in April 1979 under which approximately $52 million was collected. The adjudicated amount of principal and interest in Southwestern's favor is approximately $1.9 million. This landmark decision has further significance as a binding and a possible precedent in two additional cases. On August 7, 1980, the United States filed suit against the Sam Rayburn Dam Electric Cooperative, Inc. to recover $655,000 in unpaid charges. The District Court initially ruled but has just vacated that order in light of the Fifth Circuit decision and entered judgment in our favor. A related case before the Claims Court involving the cities of Fulton, Thayer, and Lamar, Missouri and Piggott, Arkansas also involves the interim rate making authority of the Assistant Secretary.

NEW LITIGATION

In 1980 Southwestern conducted formal hearings for the purpose of allocating the scarce low cost hydropower among many requests for service. As a result of those hearings Southwestern followed the "widespread use" guidance of its basic legislation and reallocated power from expiring contracts with non-preference customers and new hydropower to the preference customers in the States of Kansas, Louisiana and Texas, three states which were not receiving their proportionate share. The State of Arkansas on November 12, 1982, filed civil action against Southwestern for removing 150,000 KW of capacity previously sold to a non-preference customer, Arkansas Power and Light Company for the benefit of the Reynolds Metals Company. Arkansas seeks to prohibit Southwestern from marketing power outside of the river basins on which the projects are developed. The purpose is to retain the power in the state but the issues in the suit are very basic to the planning and the authority of the Administrator to allocate power, as well as an attack on the preference clause. An injunction has been requested by the state to prohibit Southwestern from entering into the new contract with preference customers in Kansas, Louisiana, and Texas as mentioned earlier. We have also been sued by Reynolds Metals Company which claims that during the period January 1, 1969, to the present Southwestern has failed to deliver all of the secondary energy required by their contract. They claim $12 million in damages.

SUMMARY

Mr. Chairman, Southwestern's budget request represents no new starts and a continuation of the present program known to this Committee for many years. The increase in Operation and Maintenance is primarily due to inflation combined with an aging wood pole system which is now approximately 30 years of age. The decrease in the construction program represents no new projects but continued funding of inventory capital equipment and modifications to the system in order to continue being a part of the interconnected grid with other utilities. The substantial increase in the purchase of power and wheeling activity represents a technical adjustment from the low funding level provided for by the FY 1983 Continuing Resolution and supplemented by carryover funds from FY 1982.

We had a good financial year by fully meeting all costs, requirements, and amortization payments. We have taken responsible financial action by requesting a new 38 percent rate increase for the system and a 25 percent increase for the Sam Rayburn Project in order to recognize projected cost increases since 1979, the last rate change. We have reduced the standard contract term of 10 years to provide flexibility in a changing industry.

The recent favorable court decisions also affirms the correctness of the action we have taken to improve Southwestern's financial condition. We are proud of the progress being made.

Mr. Chairman, its's a privilege to be associated with the customers, employees and public of Southwestern Power Administration and to have the opportunity to come before this Committee.

SOUTHWESTERN BUDGET REQUEST

Mr. RISK. The Southwestern Power Administration's request for fiscal 1984 is $36.2 million. This represents an increase of $15.4 million over funds provided by the continuing resolution of last December. Though this amount at first appears large, it primarily represents a technical increase in the purchase of power and wheeling activity. By the language of the Continuing Resolution, we received only $7.1 million for this activity, which was far below our request of $20.7 million.

This amount may be sufficient for the current year because good rainfall last fiscal year allowed us to conserve funds to carry over into this fiscal year. Heavy November and January rains filled the reservoirs both before and after the winter peak period.

The requested increase for fiscal year 1984 will be a return to our standard criteria for budgeting to cover approximately 4 months of critical year conditions.

This is why we call it a technical adjustment and not an increase in the program. The request of $9.8 million for the operation and maintenance activity funds is the heart of our program, and the increase of $730,000 recognizes the inflation factor plus the additional demands of the system approaching a normally expected service life of 35 years.

The request of $3.7 million for construction activity represents a decrease of $830,000. This decrease represents the completion of some minor projects and no new starts in the coming year.

We have had a pretty good year, even though we did not have an average year's generation and despite the fact that our current studies show that our rates are too low.

SYSTEM RATES AND REPAYMENTS

On sales of $65.7 million, we netted $14.2 million which was the amount we needed to meet our amortization obligation for the year. We conducted two major rate and repayment studies for the system and for the Sam Rayburn project, and we conducted extensive formal as well as informal public information hearings from our customers.

As the result of these studies and information exchanges, we have filed with the Department of Energy new and higher system rates and will soon file a request for the contractual rate increases for the Sam Rayburn cooperative.

The average annual system rate will increase 38 percent, or an additional $25 million, on a base of $65.2 million.

It will be only the third system rate increase in 40 years and the first since 1979. This increase also includes an innovative method to recover purchase power costs as they occur, and the rate design places greater emphasis on the demand for the capacity component to insure that future payments for amortizing the Government's investment will be made each year.

The increase from the Sam Rayburn project is 25 percent, or $349,000, on a base of $1.4 million. These increases are sorely needed to keep Southwestern on a sound financial basis.

STATUS OF PENDING LITIGATION

Last year, we mentioned settlement terms were being discussed with Associated Electric Cooperative of Missouri in an effort to resolve litigation covering the period of 1970 through 1981 amounting to $28.8 million in the dispute.

We cautiously want to inform the committee that formal settlement terms have been reached between Southwestern and Associated. These terms have been forwarded to the Department of Energy headquarters where they are being reviewed.

If DOE concurs with the settlement, the Justice Department will then be asked for their concurrence and eventual submission to the courts.

We have also received a very favorable court decision on two of our four lawsuits challenging the interim rate authority delegated to the Assistant Secretary.

On November 26, 1982, the Fifth Circuit Court of Appeals ruled in favor of Southwestern and against Tex-La Electric Cooperative and Northeast Texas Electric Cooperative.

The reversal by the fifth circuit reaffirmed the interim ratemaking of the Assistant Secretary which was used to implement rates in April 1979 under which $52 million had been collected from all of our customers.

We have also just learned that the district court, which had initially ruled in favor of the Sam Rayburn Electric Cooperative on a similar interim rate issue, has just vacated that suit in light of the fifth circuit decision, so we are extremely pleased with these 2 decisions on 3 of our 140 lawsuits.

The fourth lawsuit brought by the cities of Fulton, Thayer, and Lamar, Mo., and Piggott, Ark., was lost and will be appealed in the U.S. Claims Court.

The interim rate authority issue has not been finally resolved. This is the reason we have elected to bypass interim rates and seek implementation only on a final basis after approval by FERC.

SOUTHWESTERN ANNIVERSARY

I have one final note. On September 1 of this year, Southwestern will be observing 40 years of contributions to the Southwestern United States through the supply of low-cost electrical energy.

Southwestern has played a major role, along with the Corps of Engineers, in developing the natural resources of three major river basins. During this time, 94 billion kilowatt-hours of energy have been generated and distributed.

This low-cost hydro energy has played a major role in the development of rural and small town America.

Over $1.2 billion has been provided by this committee to both Southwestern Power and the power producing functions of the Corps of which almost $700 million, or about 57 percent, has already been returned by receipts deposited in the Treasury.

These projects will continue to benefit this country for many decades to come, and it has been a good program and one which has much to celebrate.

I am proud to be part of it and recognize the foresight provided by this committee.

Thank you, very much.

Senator McClure. Thank you.

I will turn the gavel over to Senator Huddleston.

Thank you, very much.

SOUTHWESTERN BUDGET REQUEST

Senator Huddleston [presiding]. Last year, you had estimated an unobligated balance from 1982 to 1983 of $5 million. Now in the 1984 budget, the justification shows an unobligated balance of $17.6 million at the start of 1983.

How do you explain that figure?

Mr. Risk. I am not sure I fully understand the question.

Was this the balance for power and wheeling activities primarily?

Senator Huddleston. Yes. That is what I understand.

Mr. Risk. The actual unobligated balance of $17.6 million resulted from carryover in all three budget activities and was caused by circumstances unforeseen at the time of the budget projections. We had a carryover of $1.9 million in the operation and maintenance activity for two reasons. We were reorganizing our engineering functions to make Springfield, Mo., our engineering headquarters rather than Tulsa. The delay in recruiting engineers due to the establishment of the engineering center, combined with difficulty in recruiting due to low Federal pay, caused us to fall behind in the development of specifications for contracting. Also, over $500,000 in procurement contracts were delayed until October to comply with the President's program for holding down fourth-quarter purchasing to the average of the previous third quarters.

We had a carryover of $6.7 million in the construction activity of which $5 million is due to our inability to start construction of the 17-mile Jonesboro to Hergett transmission line. The construction of this line is dependent upon negotiations with Arkansas Power & Light Co. who must construct a 500 kV/161 kV extra high voltage substation in order for the line to be useful. Arkansas Power & Light Co. has recently decided to delay construction of the line to the early 1990's due to a slower load growth rate and funding problems for this large capital investment. Because of this change, Southwestern is now assuming responsibility for a transmission study on our northeast Arkansas/southeast Missouri transmission loop to solve the potential voltage and reliability problem as a result of delaying the Jonesboro to Hergett transmission construction.

In the third activity—purchase power and wheeling—we carried over $9 million because rainfall and inflow conditions into the reservoir was 131 percent of median during the year which allowed us to meet our loads from hydrogenerators and thus not have to purchase thermal energy.

Senator HUDDLESTON. It went from $5 million in 1982 or—actually, the beginning of 1983, to $17.6 million in 1983.

Mr. RISK. Yes, sir.

Senator HUDDLESTON. The budget justification indicates a $10.1 million base for the 1984 funding request for O&M; only $9.8 million is actually requested.

Will you explain this and what result the $300,000 shortfall will have, if any?

Mr. RISK. The $300,000 difference between the operations and maintenance base of $10.1 million and the actual request of $9.8 million represents SWPA's estimate of the amount required when GS pay increases of $160,000, merit pay increases of $60,000, and medicare estimates of $65,000 are taken into consideration. These items were not allowed in accordance with budget instructions and SWPA is expected to take care of these items through savings from employee turnover.

Senator HUDDLESTON. What is the outlook for the water supply in 1984?

Mr. RISK. During the first 5 months, we have had very good inflow conditions. We have just concluded our winter peak period and the reservoirs are still 100-percent full. If we receive our traditional spring rains in March, April, and May, we should go through the summer peak months without problems.

Senator HUDDLESTON. Thank you, very much, Mr. Risk.

SOUTHEASTERN POWER ADMINISTRATION

STATEMENT OF HARRY C. GEISINGER, ADMINISTRATOR

Mr. TRIBBLE. Next will be Mr. Geisinger of the Southeastern Power Administration.

Mr. GEISINGER. Mr. Chairman, it is a pleasure to be here today to discuss with you Southeastern's proposed budget request for fiscal year 1984.

If I may, I would like to place my statement in the record and give you very brief highlights of that statement.

Senator HUDDLESTON. Your entire statement will be placed in the record.

[The statement follows:]

STATEMENT OF HARRY C. GEISINGER

It is a pleasure to appear before you today to discuss Southeastern Power Administration's (SEPA) proposed budget request for fiscal year 1984.

FY 1984 BUDGET

An appropriation of $20,594,000 is requested in the President's 1984 Budget to effectively carry out Southeastern's mission in a 10-state area of the Southeast. The requested FY 1984 appropriation represents an increase of $13,232,000 over the amount available for FY 1983.

A comparison by activities of the FY 1984 Operations and Maintenance budget request with the amounts available in FY 1983 is as follows:

	FY 1983	FY 1984	Difference
System Operation and Maintenance	$1,606,000	$ 1,751,000	+$ 145,000
Purchase Power and Wheeling Charges	5,756,000	18,843,000	+13,087,000
Total Budget Authority	$7,362,000	$20,594,000	+13,232,000

JUSTIFICATION OF INCREASES

The request of $1,751,000 for the System Operation and Maintenance activity will provide funds for the negotiation and administration of wheeling and power sales contracts; development and review of rates to assure repayment of power costs; scheduling the generation of power and supervision of power deliveries; and direction and support of Southeastern's power marketing program. This amount represents a $145,000 increase over the amount available in the current year.

Of this increase, $63,000 is required for statutory personnel increases and two additional personnel. The additional personnel are required due to the increased workload associated with the day-to-day scheduling of projects resulting from a more direct role in the operation and marketing of power from the Cumberland System anticipated in the marketing policy for that system; due to increased activity in the analysis of potential hydroelectric resources in the Southeastern area; and to maintain a reliable degree of capability in performing project operation studies.

The remaining increase in this activity is required for equipment additions and replacements including the purchase of additional ADP equipment, software, and associated costs to enhance the existing computer support and to improve billing operations, provide more reliable and timely financial data, and to perform complex hydrological and project operations studies. The funding is required to replace office equipment which has been in service for long periods of time, and to provide for nominal increases resulting from higher administrative costs for support functions (transportation of things, GSA rental, communications, and printing and reproduction).

The request also includes funding for an independent audit by a commercial firm of the financial statements of the Southeastern Federal Power Program as required by Departmental policy. The results of this examination shall be reported in a letter which attests to the validity of the financial statements. Power repayment studies prepared for the rate adjustments utilize much of the data contained in the financial statements, and this action is necessary to assure that Southeastern can adjust rates as required to keep repayment on a current basis. Previously, the financial statements have been audited biennially; however, beginning in FY 1984, Southeastern plans annual audits of the financial statements to provide for a more businesslike operation.

PURCHASE POWER AND WHEELING

The major portion of the budget request, $18,843,000, is required for the Purchase Power and Wheeling activity and represents a $13,087,000 increase over the amount available in the current year.

Funds provided for the purchase of power and wheeling are used only to pay amounts charged the Government under contractual arrangements for (1) delivery of power over non-Federal systems to load centers of preferred agencies for the account of the Government; and (2) purchase by the Government of energy to firm up Federally-generated power to the load factor required by preferred agencies, to provide support capacity required to meet commitments from the Jim Woodruff Project under adverse water conditions, and to defray other costs under drought conditions.

In the absence of ownership or operation of transmission facilities, Southeastern carries out its marketing program by utilizing the existing transmission systems of the power utilities in the area. This is accomplished through "wheeling" arrangements between Southeastern and each of the area utilities who have transmission lines connected to the projects under which the utility agrees to deliver specified amounts of SEPA power to SEPA customers and SEPA agrees to compensate the utility for the wheeling service performed.

While the law specifies that Southeastern give preference in the sale of its power to public bodies and cooperatives, Southeastern has not been able to market all elements of its power to preference customers in the past. Power not sold to the preference customers was sold to the utilities who perform the wheeling services for Southeastern. A "net-billing" process was instituted which provided that the amounts owed the utilities by Southeastern for wheeling were offset by the amounts owed Southeastern by the utilities for purchased power with the remainder being paid by the owing party. Under this arrangement, Southeastern needed only minimal appropriations to cover only those amounts where Southeastern would be the owing party after net billing.

Now, however, due to preference customer load growth and a shift in the power rate structures in the area, preference customers are able to fit all of Southeastern's peaking power into their load curves and use the power both physically and economically. For these reasons, Southeastern's new written power marketing policy for its Georgia-Alabama System and its proposed policies for the Kerr-Philpott System and the Cumberland System anticipate that in the future all power will be sold to preference customers with no sales to the private utilities who now provide the transmission services. Under these conditions there will be no money owed to Southeastern by the private utilities and Southeastern will need to actually pay the companies the total wheeling charge each month. Because of changes in wheeling and sales arrangements, the FY 1982 and FY 1983 budget requests included an increase in appropriations. As new wheeling and sales arrangements are negotiated for the respective utility areas, requests for appropriated funds will need to be further augmented, progressively increasing each year for several years into the future until total implementation of the new contracts is accomplished. While increases in appropriated funds for wheeling will be offset by similar increases in power receipts deposited in the Treasury by Southeastern, the advisability of other approaches which may reduce these budgetary requirements is being assessed.

New contracts which are planned to provide for the sale of all power to both existing and new preference customers during all or a portion of FY 1984 would cover the portion of the power produced in the Cumberland System which is proposed to be wheeled outside the TVA service area, all power produced in the Kerr-Philpott System and now marketed in the Virginia Electric and Power Company and Carolina Power & Light Company service areas, and that portion of the power produced in the Georgia-Alabama System and sold in the Southern Company service area (Georgia, Alabama, Mississippi, and Florida).

All of SEPA's costs are considered as operating expenses in the power marketing program and, as such, are generally repaid yearly to the Treasury from collected SEPA power revenues.

OVERVIEW

Southeastern Power Administration, with headquarters in Elberton, Georgia, markets hydroelectric power from projects constructed and operated by the U. S. Army Corps of Engineers and located in 10 southeastern states. Southeastern has no transmission lines and accomplishes the delivery of power by wheeling agreements with power utilities in the area that have the necessary transmission facilities.

Southeastern presently markets power from 21 multiple-purpose projects to 194 power purchasers. Estimated power revenues for FY 1984 are $84,200,000, reflecting the sale of 2,867 megawatts of installed capacity with 7.05 billion kilowatt-hours of energy. These estimates are based upon the availability of the new generating unit at the Hartwell Project and one of the generating units at the Richard B. Russell Project.

Southeastern's overall repayment status is as follows: From inception in 1950 to September 30, 1982, operating revenues available for repayment totaled

$984,370,000. These revenues were allocated to payment of $349,490,000 of annual operating expenses, $375,980,000 of interest expense, and $258,900,000 of capital investment in electric plant. The total capital plant on September 30, 1982, of $1,006,670,000, less the amount repaid, leaves a balance of $747,770,000 to be repaid.

SEPA's projects are grouped for marketing purposes into systems which are financially independent of each other. Presently there are four such systems which will continue into the future, with Laurel Project (Kentucky) operated separately for the short term. The power systems, customer locations, and status of wholesale rate adjustments are hereinafter discussed. SEPA has accomplished all of its recent rate adjustments with a minimum of difficulty.

GEORGIA-ALABAMA PROJECTS

The Georgia-Alabama Projects are comprised of the Allatoona, Buford, Carters, Clarks Hill, Walter F. George, Hartwell, Robert F. Henry (formerly Jones Bluff), Millers Ferry, and West Point projects. Two of the four units at Carters are pumping units. Power from the system is sold to customers located in Georgia, Alabama, North and South Carolina, Mississippi, and Florida.

Power rates for this system were approved on a final basis by the Federal Energy Regulatory Commission on April 3, 1981, for a period ending September 30, 1983. Replacement rates established to implement the new written power marketing policy for customers in the Duke Power Company area were approved on a final basis by the Federal Energy Regulatory Commission on April 9, 1982, also for a period ending September 30, 1983.

Construction work on the fifth generating unit at the Hartwell Project is on schedule and will provide an additional 80,000 kw of capacity to the existing 264,000 kw plant during calendar year 1983.

Construction on the Richard B. Russell Project is over 80 percent complete and on schedule for having power-on-line during FY 1984. The four conventional power units, which will have a capacity of 300,000 kw, are scheduled to be online during FY 1984 and FY 1985. The four pump-storage units, which will provide an additional capacity of 300,000 kw, are scheduled to have power-on-line during FY 1988 and FY 1989.

The addition of the 680,000 kw of generating capacity within these two projects will represent the most significant increase in the marketing product of Southeastern Power Administration since 1975.

CUMBERLAND BASIN PROJECTS

The Cumberland Basin Projects include the Wolf Creek, Center Hill, Dale Hollow, Old Hickory, Cheatham, Barkley, J. Percy Priest, and Cordell Hull projects. The projects are located on the Cumberland River or its tributaries and are all in northern Tennessee and southern Kentucky.

System power is marketed to customers located in the Tennessee Valley Authority area and in portions of Kentucky, Indiana, and Illinois. Power rates which include a 16 percent increase for this system were approved on an interim basis effective retroactively to July 1, 1978. The Federal Energy Regulatory Commission approved these rates on February 27, 1981, for a period ending June 30, 1983.

As indicated, it is anticipated that a ninth project, Laurel, now operated as an individual project, will be included within the Cumberland system when the new policy is implemented.

KERR-PHILPOTT PROJECTS

Power from the John H. Kerr and Philpott projects, located in the Roanoke River Basin in Virginia, is marketed to customers in Virginia and North Carolina. Power rates were extended and rates were increased for the preference customers served by the Carolina Power and Light Company. On September 2, 1982, the Assistant Secretary for Conservation and Renewable Energy approved on an interim basis the rate extension and increase effective October 1, 1982, for a period ending March 31, 1983. The rates were forwarded to the Federal Energy Regulatory Commission for final approval.

JIM WOODRUFF PROJECT

The Jim Woodruff Project is located on the Apalachicola River on the Georgia-Florida state line. All dependable capacity available at the Project is sold to preferred customers in peninsula Florida.

Revised power rates for the Jim Woodruff Project were approved on a interim basis by the Assistant Secretary for Conservation and Renewable Energy and were placed in effect on August 20, 1982. Final approval of the rates was issued by the Federal Energy Regulatory Commission on January 10, 1983, for a period ending August 19, 1987.

POTENTIAL ADDITIONAL RESOURCES

SEPA has been coordinating with various District offices of the Corps of Engineers in examining the possibility of installing generating units at several existing projects in the area within which SEPA is authorized to market power. The Summersville Project, the Tygart Project, and the Stonewall Jackson Project in West Virginia as well as the B. Everett Jordan Project in North Carolina are being considered and studied for potential hydropower development.

POWER MARKETING POLICY FORMULATION

As previously reported to the Committee, preference agencies' interest in purchasing power from Southeastern has increased substantially during the past few years. It has also been reported that these requests for power from agencies throughout the area come at a time when only one new project, the Richard B. Russell Project, is scheduled to begin operation and only this project, together with the installation of a fifth generating unit at the Hartwell Project, will provide additional Federal power resources during the immediate future years.

Responding to this increased interest, SEPA adopted a public participation procedure which would allow a review of existing policies and, where and when appropriate, to issue new written power marketing policies for the agency's respective systems. Following this procedure, SEPA has published a new written power marketing policy for its 10-project Georgia-Alabama System of Projects and has further negotiated and placed in effect the first major wheeling arrangement under the new policy. This contractual arrangement is with Duke Power Company and 22 preference agencies served from its transmission system. All capacity and energy available to the Duke area is sold to preference customers as anticipated by the policy. Because no power is sold to the Company to effectuate "net-billing", SEPA is relying on appropriations authorized to accommodate the new policy arrangements. As other such arrangements are negotiated and placed in effect, additional appropriations will be needed to pay for the wheeling services provided by the contracting utilities, unless alternative approaches now under review can be devised to reduce these budgetary requirements.

Southeastern expects to issue and publish final power marketing policies for both its Cumberland and Kerr-Philpott Systems during 1983 or early 1984. A proposed policy has been issued for the Cumberland System, and an interim policy and a revised proposed policy have been issued for the Kerr-Philpott System. Contracts were negotiated with VEPCO and 16 preference customers in the VEPCO area implementing the interim policy. Negotiations to implement the interim policy in the CP&L area are nearing completion.

Public forums have been held with respect to the proposed policies for both systems and written comments have been solicited. These oral and written comments, along with the results of numerous consultations, will be evaluated prior to proceeding with the issuance of final policies for the respective systems. With respect to the Cumberland System, this is the first real opportunity to consider the overall area that SEPA might serve. The proposed policy suggests that the area would consist of the TVA area and those utility areas which join the TVA area which SEPA is not now serving or considering serving from its other systems. SEPA does not anticipate policy action with respect to its Jim Woodruff Project in the near future. Following finalization of its pending policies, SEPA plans to negotiate contracts for future sales which reflect the policy decisions.

LITIGATION

SOUTHEASTERN POWER ADMINISTRATION V. KENTUCKY UTILITIES COMPANY, BEFORE THE FEDERAL ENERGY REGULATORY COMMISSION

Because SEPA was unable after five years of negotiations to obtain a reasonable contract with KU for wheeling 25 megawatts of Cumberland River Basin power to eight Kentucky municipalities, the agency filed an application with the Federal Energy Regulatory Commission pursuant to Sections 211 and 212 of the Federal Power Act requesting the Commission to order KU to wheel the power for SEPA on fair and reasonable terms. Several of the municipalities intervened in support of the application. The matter was heard in March and April 1981, with the Presiding Administrative Law Judge later ruling that the Commission lacked authority to order the requested wheeling. Exceptions were taken to the ruling, and the matter is now before the full Commission for review.

GREENWOOD (MISS.) UTILITIES COMMISSION V. EDWARDS AND WRIGHT

The Greenwood, Mississippi, Utilities Commission, located outside the geographically selected marketing area for Georgia-Alabama System power, filed Complaint in Federal District Court in April 1977 alleging that SEPA and the Department of Interior violated Section 5 of the Flood Control Act of 1944 and otherwise acted unlawfully in contracting for the sale of power to other customers while denying Greenwood an allocation of power. Numerous SEPA customers intervened on behalf of the Government. Extensive discovery has been accomplished and several motions have been acted upon. A motion for partial summary judgment filed by the Defendants resulted in a reduction of the number of issues which must be tried. Discovery has been completed, and pretrial briefs and the trial may follow later in 1983.

ELECTRICITIES OF NORTH CAROLINA, ET AL. V. SEPA AND DOE

On July 29, 1982, ElectriCities of North Carolina filed suit in the Eastern District of North Carolina against SEPA and DOE attacking, on behalf of 60 Virginia, North and South Carolina municipals, SEPA's final Georgia-Alabama marketing policy and its interim and revised proposed policy for its Kerr-

Philpott Systems. Specifically, the marketing areas proposed, methods of allocations, and SEPA's four-system marketing approach are attacked in favor of a single-system approach for the entire 10-state Southeastern area of the United States. The Government, supported by numerous intervenor customers of SEPA, moved to dismiss on November 2, 1982, and on January 28, 1983, the final briefs and responses to the motion were filed. Extensive legal activity with respect to this case is anticipated even though SEPA proposes in its policies to serve the vast majority of the complaining cities.

SOUTHEASTERN BUDGET REQUEST

Mr. GEISINGER. An appropriation of $20,594,000 is requested in the President's 1984 budget. This is an increase of $13,232,000 over the amount available for fiscal year 1983.

The request of $1,751,000 for the system operation and maintenance activity will provide funds for the negotiation and administration of wheeling and power sales contracts; development and review of rates to assure repayment of power costs; scheduling the generation of power and supervision of power deliveries; and direction and support of Southeastern's power marketing program. This amount represents a $145,000 increase over the amount available in the current year.

Of this increase, $63,000 is required for statutory personnel increases and two additional personnel. The request also includes funding for an independent audit by a commercial firm. The remaining increase in this activity is required for equipment additions and replacements.

PURCHASE POWER AND WHEELING

The major portion of the budget request, $18,843,000, is required for the purchase power and wheeling activity and represents a $13,087,000 increase over the amount available in the current year.

In the absence of ownership or operation of transmission facilities, Southeastern carries out its marketing program by utilizing the existing transmission systems of the power utilities in the area. Southeastern has not been able to market all of the elements of its power to preference customers in the past. Now, however, due to preference customer load growth and a shift in the power rate structure in the area, preference customers are able to fit all of Southeastern's peaking power into their load curves and use the power both physically and economically.

For these reasons, all power will be sold to preference customers with no sales to the private utilities who now provide the transmission services. Under these conditions, there will be no money owed to Southeastern by the private utilities and Southeastern will need to actually pay the companies the total wheeling charge each month.

As new wheeling and sales arrangements are negotiated for the respective utility areas, requests for appropriated funds will need to be further augmented, progressively increasing each year for several years into the future until the total implementation of the new contracts is accomplished.

Increases in appropriated funds for wheeling will be offset by similar increases in power receipts deposited in the Treasury by Southeastern.

OVERVIEW OF SOUTHEASTERN

Southeastern presently markets power from 21 multipurpose projects to 194 power purchasers. Estimated power revenues for fiscal year 1984 are $84,200,000, reflecting the sale of 2,867 megawatts of installed capacity with 7.05 billion kilowatt-hours of energy.

Southeastern's overall repayment status is good. From inception in 1950 to September 30, 1982, operating revenues available for repayment totaled $984,370,000.

POWER MARKETING POLICY FORMULATION

As previously reported to the committee, preference agencies' interest in purchasing power from Southeastern has increased substantially during the past few years. It has also been reported that these requests for power from agencies throughout the area come at a time when only one new project, the Richard B. Russell project, is scheduled to begin operation, and only this project, together with the installation of the fifth generating unit at the Hartwell project, will provide additional Federal power resources during the immediate future years.

Mr. Chairman, that completes my statement, and if you have any questions, I would be happy to answer them.

Senator HUDDLESTON. Fine. When do you anticipate the Laurel project, which seems to be operating as an individual project, will come in?

Mr. GEISINGER. With the implementation of the Cumberland policy, which is very close to being completed, the Laurel project will be included within the Cumberland system.

Senator HUDDLESTON. So it is imminent, in other words?

Mr. GEISINGER. Yes, sir.

PRESENT POWER RATES

Senator HUDDLESTON. If your present rates are approved through June 30, what do you anticipate will happen then?

Mr. GEISINGER. With the workload we have, an extension may be needed.

Senator HUDDLESTON. Extend or increase?

Mr. GEISINGER. No. We may need to extend the contract for a period of time, probably a year, while we proceed with contract negotiations to implement the Cumberland system marketing policy decisions. We anticipate a small increase in rates for a 1-year period.

Senator HUDDLESTON. The power that you sold to the companies that were conducting the wheeling operations for you, was it at the same rates as if you were selling to a normal customer?

Mr. GEISINGER. Do you mean the same rate that we would charge the preference customers?

Senator HUDDLESTON. Yes.

Mr. GEISINGER. The rates charged the private utilities and the customers for capacity are currently the same.

Senator HUDDLESTON. You did offset it against the costs, though?

Mr. GEISINGER. Yes, sir. The wheeling costs were handled as a net billing.

Senator HUDDLESTON. It was a tradeout, but you were using the same figure you used for preference customers?

Mr. GEISINGER. Yes, sir.

RELOCATION OF HEADQUARTERS

Senator HUDDLESTON. Senator Nunn has expressed a concern to the subcommittee over a newspaper report that apparently appeared out of Georgia suggesting studies are underway regarding the relocating of your office from its present location to the metropolitan area of Atlanta. Other members have an interest in that, too.

Is there such a study? If so, how much are you requesting for it and what are your interpretations?

Mr. GEISINGER. There is a memorandum from the Department of Energy requesting that we do a feasibility study. There is no request for funds in this budget for that.

The feasibility study, when completed, will be submitted to the Department of Energy.

Senator HUDDLESTON. The decision will be made there?

Mr. GEISINGER. Yes, sir.

Senator HUDDLESTON. Is the feasibility study underway at the present time?

Mr. GEISINGER. No, sir. We were waiting for the budget hearing to be completed and get beyond this point. Then we were going to go ahead with that.

Senator HUDDLESTON. And you will do it within existing appropriations?

Mr. GEISINGER. The study itself?

Senator HUDDLESTON. Yes. So you are not asking for more money?

Mr. GEISINGER. Yes, sir. We are not asking for anything.

Senator HUDDLESTON. I'm sure that Senator Nunn would like some kind of assurances that he, or perhaps the subcommittee, would be advised as to what the recommendations are from that study before a final decision is made. Could we have that kind of assurance?

Mr. GEISINGER. Yes, sir.

REVENUE ESTIMATES

Senator HUDDLESTON. I note that the Southeastern power revenue estimate for 1984 is $84 million, an increase of $20 million over 1983. What accounts for that large increase?

Mr. GEISINGER. We will have additional generation coming on line, the Richard B. Russell project and the fifth unit at the Hartwell project, plus a great portion of that increase is based on the fact that we will not be net billing with some of our investor-owned utilities and, consequently, those revenues will pass through for the wheeling costs.

With the elimination of net billing, we are actually bringing those revenues in and passing them on to the Treasury.

Senator HUDDLESTON. There is no doubt that the demand is there?

Mr. GEISINGER. Yes, sir; no doubt.

Senator HUDDLESTON. Does that indicate a general growth in the area?

Mr. GEISINGER. It indicates our rates are extremely favorable, and if we had twice as much capacity, they would be happy to take it from us.

Senator HUDDLESTON. Could you provide for the record a comparison of the revenue estimates presented in your budget justifications and what the actual revenues were for the past 5 years?

Mr. GEISINGER. Will we provide that for the record? Yes, sir.

[The information follows:]

SOUTHEASTERN POWER REVENUES

A comparison of revenue estimates presented in budget justifications with actual revenues received for the 5-year period fiscal year 1978 through fiscal year 1982 reflects that, in the 3 years, 1978 through 1980, actual revenues exceeded the estimates. Actual revenues for fiscal year 1981 and fiscal year 1982 were lower than estimated due to severe drought conditions which occurred during the period from June 1980 through December 1981. In fiscal year 1982 generation was lower than average due to continued low inflows in some systems and the necessity of refilling reservoirs following the drought period.

The information for each year is as follows:

[In thousands of dollars]

	Fiscal year—				
	1978	1979	1980	1981	1982
Budget justification revenue estimates	$50,910	$55,600	$58,300	$60,500	$65,700
Actual revenues	53,926	58,706	63,793	57,264	60,913

ADDITIONAL PERSONNEL

Senator HUDDLESTON. You are requesting two additional full-time permanent positions for 1984. What type positions are these?

Mr. GEISINGER. Both of them are in the engineering field. One will be working in the day-to-day scheduling of projects in the Cumberland system. Up to now, we have not operated the Cumberland system as we have the other systems where we are directly involved in the scheduling of the projects.

We will assume a more direct role under the new policy. The other position will be working with the analysis of potential hydroelectric resources in the Southeastern area with project operations studies and with environmental actions.

Senator HUDDLESTON. It sounds to me like something eminently needed.

Mr. GEISINGER. If they are not there, then we will have some problems on our hands.

Senator HUDDLESTON. What are the costs of those two positions?

Mr. GEISINGER. The increased fiscal year 1984 personnel costs, including the statutory increases, are $63,000, of which $50,000 is required for additional positions.

Senator HUDDLESTON. What would be the impact if they were not permitted?

Mr. GEISINGER. If we look back at the history of SEPA, it started with about 84 employees 30 years ago and has slowly dwindled away to less and less personnel with the workload continuing to increase.

Part of the decrease was caused by the fact that some of those employees were back in the days when SEPA was constructing transmission lines. We now have no transmission lines.

We have a very thin operation and find ourselves in a position of having more capacity and energy to sell, and at the same time, we are implementing a new power marketing policy under which all of the capacity and energy will be sold to existing and additional preference customers.

We are in a period of intense contract negotiation and implementation of about 3 years which requires more personnel.

AUTOMATED DATA PROCESSING EQUIPMENT

Senator HUDDLESTON. What about the $65,000 for additional automated data processing equipment? What kind of equipment is that and the total cost?

Mr. GEISINGER. Do you mean by make and models? It is a Texas Instruments 990.

Senator HUDDLESTON. And $65,000 will cover that?

Mr. GEISINGER. Well, the TI-990 is in place. The request is for additional capacity to enhance existing equipment, software purchases, and maintenance.

Senator HUDDLESTON. Adding to it?

Mr. GEISINGER. Yes, sir.

WATER SUPPLY OUTLOOK

Senator HUDDLESTON. What does the water supply situation in the Southeastern area look like?

Mr. GEISINGER. Our reservoirs at present are full. It was raining when I left Georgia and I suspect every project is generating as fast as it can. We expect normal or near normal conditions throughout the area for the remainder of 1983.

Senator HUDDLESTON. Thank you, very much.

Mr. GEISINGER. Thank you.

Senator HUDDLESTON. Are we ready for our last witness?

Mr. TRIBBLE. Mr. Johnson has a plane to catch at 5 and would like to be excused.

ADDITIONAL PREPARED QUESTIONS

Senator HUDDLESTON. Thank you for answering the questions. Senator Mattingly has submitted some questions for your response.

[The questions and answers follow:]

QUESTIONS SUBMITTED BY SENATOR MATTINGLY

SOUTHEASTERN LITIGATION

Question. We notice there are several lawsuits against Southeastern. Please explain the general reasons for the lawsuits.

Answer. The basic problems causing agitation between certain preference entities and Southeastern is grounded in the relationship of resources to demand. There is a very large preference entity demand in the area where Southeastern is authorized to market power and a relatively small amount of resources. Furthermore, the low cost of the power makes it extremely attractive. The low cost is a result of the projects being constructed some years ago and the further fact that they are relatively unaffected by inflation. The number of dissatisfied entities is small in relation to the total and many of these will, under the existing or proposed power marketing policies, be offered SEPA power. Again, because of the small quantity of power available and the fact that previous marketing patterns cannot be ignored, all dissatisfaction cannot be removed. We are making every reasonable effort to minimize the dissatisfaction.

REDUCING BUDGETARY REQUIREMENTS

Question. In your statement you say that efforts are underway to devise means of reducing budgetary requirements for the purchase power and wheeling activity. Please explain the methods under consideration for reducing this activity.

Answer. There are two approaches currently under consideration. We are considering requesting an operating fund which would allow Southeastern to utilize its revenues to fund the purchase power and wheeling activity. We believe this would be the most efficient and functionally proper approach to the problem. It would eliminate completely the need for appropriations to cover this activity.

In addition, the OMB has requested that we consider some method whereby the costs of wheeling services provided Southeastern by the privately owned utilities may be made the direct responsibility of the preference customers. We are concerned with insuring that any new procedures which may be considered allow Southeastern to carry out its statutory responsibilities and that all interested parties, including DOE, OMB, GAO, congressional committees, and the preference customers, be in agreement with an acceptable approach along these lines.

ALASKA POWER ADMINISTRATION

STATEMENT OF ROBERT J. CROSS, ADMINISTRATOR

Mr. TRIBBLE. In a meeting the other day, the Administrator of the Alaska Power Administration said he generates more power than all the rest combined. He is right. I call on Bob Cross from the Alaska Power Administration.

Mr. CROSS. Thank you.

Mr. Chairman, it is a pleasure that we are finally down to the last of the witnesses today.

Senator HUDDLESTON. The first was last it looks like.

Mr. CROSS. I will briefly highlight from the statement that will be in the record.

ALASKA POWER BUDGET REQUEST

Our budget request of $3.2 billion is quite routine. It provides adequate funds to continue our responsibilities for our two operating projects. It includes $100,000 to continue the phaseout of our investigations work.

Our sales and revenues last year were both records for us. In 1984, we are projecting revenues of about $6.1 million. We are pleased to report that both projects are meeting the payment requirements under their respective legislation.

SNETTISHAM PROJECT, CRATER LAKE UNIT

We do have what I consider to be an urgent need for power from the next stage of the Snettisham project which is the Crater Lake unit. Design work and engineering work is well underway, so that I hope that arrangements for construction funding can be worked out soon.

ALASKA TRANSMISSION PROBLEMS

We furnished the committee a letter report last year on a transmission problem that we had which was loss of a tower at Snettisham due to unexpected failure of two guy grips. We followed this up with a quite expensive summer maintenance program which found four partial guy grip failures at additional structures. We have corrected those problems and I now believe we have a redesigned maintenance program that will avoid similar failures in the future. The extra cost of this work did cause us to defer some other work that we had planned to do.

ALASKA EMERGENCY FUND

Our 1984 request asks for emergency funds in an unspecified amount to be made available only if an emergency actually occurs. I think this approach is well suited for Alaska, for our Administration has risks in a pretty wide variety of hazards, including some potentially more costly than last year's problem. However, we will not need emergency funds in most years.

STATE AND FEDERAL POWER PROGRAMS

Referring back to past years' testimony, we have noted the progress of the State-financed power development programs in Alaska and our support of these activities.

As the State programs mature, the relative importance of the work that we are doing does diminish. We are at the point when many people feel that we should look at a combination of the State and Federal power programs in Alaska. There is interest in Alaska in exploring the idea; both OMB and DOE have indicated they would be receptive if a sensible plan could be worked out.

I plan to work over the next several months with the State counterparts and our customers to examine in detail how a merger of the two programs might be accomplished.

Senator HUDDLESTON. Is this effort going on actively now?

Mr. CROSS. It is going on actively now on an informal basis, yes. It would require legislation at both the State and Federal levels before anything like this could happen, of course.

I believe that concludes my brief notes for you.

Thanks for the chance to be here.

[The statement follows:]

Statement of Robert J. Cross

I am pleased to present the Alaska Power Administration's budget proposals for FY 1984, along with notes on our activities over the last year.

APA is responsible for operations, maintenance, transmission and marketing for the Federal hydroelectric projects in Alaska and for investigations in future water and power development. Our two projects--Eklutna and Snettisham--now provide roughly 9 percent of the energy requirements for Alaska's electric utilities.

For FY 1984, we are requesting $3,210,000 in new appropriations, together with an unspecified amount to be available in case of emergency. The request provides adequate funds for the operating projects and includes $100,000 to continue the phase out of the investigations work.

With the exception of some rather costly transmission work, our programs have proceeded as planned over the last year and the results have been good.

SALES AND REVENUES

Our FY 1982 sales of 313 million kWh and gross revenues of $4.3 million were records for us. We are projecting further revenue increases in FY 1983 and 1984 through increasing utilization of Snettisham power and rate changes.

We reported last year that we were approaching full utilization of firm energy from the first stage of Snettisham and that rate actions to end the interest deferrals under the 1976 law which governs Snettisham repayment would follow. Our plan is to have the new rates in place on December 1, 1983. A smaller rate increase is also planned for Eklutna this year. We're pleased to report both projects continue to meet repayment requirements under their respective legislation.

With the projected rate changes and increased utilization of Snettisham power, we are estimating gross revenues of $6.1 million in FY 1984.

Accomplishments in the program include completion of the avalanche protection measures on the Snettisham line; the major overhaul of the Eklutna generating units; and the replacement office space at Eklutna.

CRATER LAKE UNIT

The Corps of Engineers has made good progress on final designs for the Crater Lake or second stage of Snettisham project, but arrangements for construction funding are not yet complete. Crater Lake will add 27,000 kW and 106 million kWh firm energy, which is about a 60 percent increase over present project. We'll continue to work with the Corps and others to seek timely completion of this much needed unit.

TRANSMISSION PROBLEMS

I reported at last year's hearings that we had not used the $50,000 appropriated for emergencies. That situation changed on March 9, 1982, with loss of a 105-foot tall guyed aluminum tower on the Snettisham Project transmission line. Repairs required 2 weeks and $108,036, with $50,000 from the emergency funds and $58,036, from other O&M funds.

Loss of the tower was caused by unexpected failure of two guy grips. This caused us to enter into an intensive maintenance and inspection program in the summer of 1982. Our crews worked on 91 structures, changing out the grips, retensioning guys, and correcting minor hardware problems. Partial guy grip failure was discovered and corrected at four additional structures. We will complete the detailed inspection and maintenance on the balance of this line in the summer of 1983, and have set up a new schedule for periodic maintenance for all line structures.

Our total cost for the repairs and the intensified maintenance work in 1982 and 1983 is estimated at $346,000.

CHANGES IN THE OPERATIONS AND MAINTENANCE PROGRAM

The unplanned costs for the transmission work, along with cost increases in construction of the avalanche protection measures on the Snettisham line used up funds that had been programed to purchase and install static exciters for the Eklutna generators and shunt reactors for the Snettisham line. These two items are thus in deferred status, and we'll try to include them in future budgets.

FY 1984 REQUEST

For the most part, the FY 1984 request is routine. The normal continuing operation and maintenance requirements are covered and we are requesting $425,000 for replacements and major maintenance items. The largest items are salvage of 15 aluminum towers from the Salisbury Ridge portion of the Snettisham line and purchase of a front end loader.

The request includes $100,000 to continue an orderly phase out of the investigations program. Anticipated FY 1984 activities are concluding the present studies of interconnection between the Snettisham Project and other areas of Southeast Alaska and continuing the statistical work until the State is in a position to take over that work.

The request contemplates a new approach for covering emergency funds, which involves an unspecified amount to be available only if an actual emergency occurs. This is a flexible approach which appears well suited for APA. We have risks to a fairly wide variety of emergency problems, including some that could be substantially more serious than last year's tower failure, and others that could be handled with minor adjustments of the regular O&M funds. At the same time, with our two powerplants and only 90 miles of transmission line, we won't have need for emergency funds in most years.

STATE AND FEDERAL POWER PROGRAMS

In past years, I have mentioned the important progress in State-financed, Alaskan power development programs. The State is now operating one small hydroelectric project; three more are in construction and scheduled for 1984 completion. Other important projects are in the investigations or design stages. We have supported these State initiatives to the best of our ability.

As the State programs mature, the relative importance of the Federal power programs in Alaska diminishes. This is the reason for the planned phase out of APA's investigation work. In a major recent move, the State requested and the Congress acted on termination of the 1962 Federal authorization for the Bradley Lake hydroelectric project. The State is proceeding with engineering and designs and preparation of a FERC license application.

This leads logically to the thought that the State and Federal power programs in Alaska should be combined. There is considerable interest in Alaska in exploring this idea. OMB and DOE would be receptive if a sensible plan can be worked out.

Over the next several months, I plan to work closely with our State counterparts and our customers to examine in detail how a merger of the two programs might best be accomplished.

In the meantime, we'll continue to do our best in carrying out our present responsibilities. The FY 1984 budget request would provide adequate funding to do that.

DEFERRED REPLACEMENTS

Senator HUDDLESTON. These deferred items that were necessary because of your emergency work, when would they be coming back into the budget request?

Mr. CROSS. We are just starting in the 1985 cycle and we, frankly, have not yet determined our new set of priorities for the multiyear program for major replacement items. They aren't what I would call critical items, but they are much-needed items.

Senator HUDDLESTON. They don't affect the reliability of the system?

Mr. CROSS. In a minor way one does. They are the shunt reactors in the Snettisham program, but not in such a fashion that I would call critical.

SNETTISHAM PROJECT, CRATER LAKE UNIT

Senator HUDDLESTON. What is the position of the State of Alaska regarding the construction of the Crater Lake unit of the Snettisham hydroelectric project?

Mr. CROSS. It is hard to speak for the State, but they have always said that they would prefer to see the project completed by the Federal Government.

Senator HUDDLESTON. But the State has indicated a desire to construct the $200 million Bradley Lake project?

Mr. CROSS. Yes, sir. The Federal authorization for Bradley Lake was terminated with the continuing resolution. The State is now preparing engineering design and preparing the FERC license. If everything goes well, they would be in a position to start construction possibly in about 2 years.

Senator HUDDLESTON. Does that have some influence on their attitude toward the Crater Lake project?

Mr. CROSS. Yes. I'm certain that it does.

Senator HUDDLESTON. Is there any chance that the falling oil prices could have some influence on the State's ability or inclination to participate in some of those projects?

Mr. CROSS. It has brought down the revenues to the State considerably, although, in my opinion, they're still placing pretty high priority on the power programs. It might slow the power programs up.

Senator HUDDLESTON. What are your projections for future power needs in the Juneau area relative to the need for the Crater Lake unit?

Mr. CROSS. Mr. Chairman, our latest study shows that with Crater Lake power coming on line in about 1987, we would use 60 to 70 percent of the capability of that unit in the first year.

Senator HUDDLESTON. The first year?

Mr. CROSS. Yes.

Senator HUDDLESTON. I believe that is all the questions I have.

Mr. TRIBBLE. We thank you very much for the opportunity, Mr. Chairman.

Senator HUDDLESTON. We thank all of you for coming before us. We will be giving due consideration to your requests.

Mr. TRIBBLE. Thank you very much.

SUBCOMMITTEE RECESS

Senator HUDDLESTON. The committee will recess subject to the call of the Chair.

[Whereupon, at 4:01 p.m. Thursday, February 24, the subcommittee was recessed to reconvene at 2 p.m. Tuesday, March 1.]

ENERGY AND WATER DEVELOPMENT APPROPRIATIONS FOR FISCAL YEAR 1984

TUESDAY, MARCH 1, 1983

U.S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Washington, D.C.

The subcommittee met at 2 p.m. in room SD–192, Dirksen Senate Office Building, Hon Mark O. Hatfield (chairman) presiding:

Present: Senators Hatfield and Johnston.

DEPARTMENT OF ENERGY

NUCLEAR FISSION AND URANIUM ENRICHMENT PROGRAMS

STATEMENT OF SHELBY T. BREWER, ASSISTANT SECRETARY FOR NUCLEAR ENERGY

ACCOMPANIED BY:
- ROBERT L. MORGAN, PROJECT DIRECTOR, NUCLEAR WASTE POLICY ACT PROJECT OFFICE
- WILLIAM R. VOIGT, JR., DEPUTY ASSISTANT SECRETARY FOR URANIUM ENRICHMENT AND ASSESSMENT
- FRANKLIN E. COFFMAN, DIRECTOR, OFFICE OF TERMINAL WASTE DISPOSAL AND REMEDIAL ACTION
- GORDON CHIPMAN, DEPUTY ASSISTANT SECRETARY, REACTOR PROGRAMS
- MICHAEL LAWRENCE, DIRECTOR OF STORAGE, NUCLEAR WASTE POLICY ACT PROJECT OFFICE

OPENING REMARKS

Chairman HATFIELD. The hearing will come to order.

This afternoon, we continue our examination of the fiscal year 1984 budget request for the Department of Energy. The purpose of this hearing is to receive testimony on the fission and uranium enrichment programs.

In behalf of the subcommittee, I welcome Dr. Shelby Brewer, Assistant Secretary for Nuclear Energy, and Robert L. Morgan, Project Director, Nuclear Waste Policy Act Project Office.

PREPARED STATEMENT

Your prepared statement shall be placed in the record as if given and you may proceed to summarize.

[The statement follows:]

STATEMENT OF SHELBY T. BREWER, ASSISTANT SECRETARY FOR NUCLEAR ENERGY

Mr. Chairman and Members of the Committee, I am pleased to appear before you today to discuss the proposed Department of Energy fission energy budget. The FY 1984 funding request for nuclear programs is $837 million in budget authority. This compares to $760 million for FY 1983. Distribution of the funds among the program elements is as follows:

	FY 1983 (in millions)	FY 1984
Uranium Enrichment	$1,942	$2,240
Uranium Enrichment Revenues	-1,968	-2,240
Commercial Waste Management	18[1]	16[1]
Remedial Actions	63	94
Breeder Reactor Systems	550	603
Converter Reactor Systems	79	53
Fuel Cycle	37[2]	37[2]
Advanced Nuclear Systems	39	34
Total	$ 760	$ 837

[1] Excludes $24 million in FY 1983 and $7 million in FY 1984 for activities now managed by the Nuclear Waste Policy Act Project Office.

[2] Excludes $6 million in FY 1983 and $5 million in FY 1984 for activities now managed by the Nuclear Waste Policy Act Project Office.

Mr. Chairman, the agenda that I am proposing for FY 1984 should hold few surprises for the Committee. Last year, when I appeared before you, I announced a realignment of my programs and organization to conform with and be responsive to the nuclear policy that President Reagan had announced in October of 1981. I also told you that I had introduced a "management-by-objective" approach into nuclear programs that allowed for concentration on major goals and elimination of work not directly related to the President's policy initiatives. As a result, we have made real progress toward meeting the President's policy objectives: specifically, waste legislation is in hand, Clinch River is progressing on an accelerated schedule, and we are ready to submit licensing reform legislation. In addition, notable progress continues at TMI, GCEP, and West Valley. Very recently a Memorandum of Understanding was signed by DOE, NASA, and Defense which provides a framework for our space reactor effort. These achievements demonstrate our resolve to produce results rather than engage in protracted study.

I would like to point out that the programs we have planned for FY 1984 are entirely consistent with the appropriate Government role in energy development as defined by the Administration. The elements of this role as applied to nuclear energy include:

- stabilizing Federal policy for time periods commensurate with the leadtimes required in nuclear development;
- removing unnecessary regulatory impediments that have developed over the years;
- fulfilling Federal responsibilities for certain elements of the fuel cycle, such as uranium enrichment; and
- conducting high-cost, high-risk, research and development that is of significant benefit to the Nation but beyond the current capability and resources of the private sector.

Before describing the program elements in detail, I would like to comment briefly on some of the highlights and issues in our nuclear program.

URANIUM ENRICHMENT

The actual cost to the taxpayer of the FY 1984 uranium enrichment program is zero. We expect to realize $2.24 billion in enrichment revenues which will completely offset the requested funds. Uranium enrichment has been an enterprise of the United States Government, dating back to the days when it was developed for defense purposes. Since that time, we have provided enrichment services to both domestic and foreign civilian customers.

Prior to 1974, the United States was the only enrichment supplier in the world market. Today the USSR and two consortia (URENCO and EURODIF) are our active competitors. By utilizing extremely aggressive marketing strategies, this competition has been able, in one decade, to reduce the U.S. share of the foreign enrichment market from 100 percent to about 30 percent. In addition, significant inroads are being made in our domestic enrichment sales. Our market performance in the future will depend primarily on our ability to offer low-cost enrichment services under favorable contract terms.

To meet this challenge, we are taking a number of actions which are designed to enhance the market position of the U.S. uranium enrichment program. Specifically, steps are being taken to minimize the current selling price by reducing costs and optimizing enrichment production activities. Our success in this area is reflected in our recent announcement that there will be no increase this year in the charge for enrichment services. A new enrichment contract, the Facility Requirements (FR) contract, is also under development to provide needed stability between enrichment commitments and actual requirements by offering greater contract flexibility to customers. Finally, advanced, low cost technologies are being developed and deployed on a schedule designed to make the most economically attractive enrichment services available to U.S. customers in the post 1990 time period.

Currently we are enriching uranium by means of the gaseous diffusion process. A far more cost effective process is gas centrifuge. In addition to providing separative work units (SWUs) at a significantly lower cost than is currently possible, the centrifuge process uses approximately 5 percent of the energy that gaseous diffusion consumes. We are constructing the Gas Centrifuge Enrichment Plant (GCEP) at Portsmouth, Ohio. Construction progress has been excellent and we expect the first increment of plant production to begin in 1989. A large fraction of the funds we are requesting for FY 1984 will go for GCEP construction. When considering the uranium enrichment request, one critical factor must be kept in mind. Without lower cost enrichment technology, the United States Government will price itself out of the multibillion dollar enrichment business.

Beyond centrifuge, we are developing the Atomic Vapor Laser Isotope Separation (AVLIS) technology which has the potential for additional cost savings and energy consumption advantages. Last spring this process was selected from three candidates for engineering development. While progress to date has been most encouraging, the AVLIS technology is not sufficiently mature to permit deployment before the mid-1990s.

Finally, I would like to point out that in FY 1984 we have decided to operate our gaseous diffusion plants at slightly higher power levels than in FY 1983. This will require the purchase of an additional 530 megawatts of power, which, incidentally, will reduce demand charges for power not purchased. The increase in power is in response to recent technical studies which concluded that prolonged plant operations below design levels could incur risk of equipment failure. Continued operation at lower power levels also jeopardizes the Department's ability to meet scheduled customer deliveries in a timely manner.

WASTE MANAGEMENT

The progress made over the last year in the area of waste management is an accomplishment of which we can all be proud. With the passage of the Nuclear Waste Policy Act we have a basis in law for a sharply focused program and a definite schedule.

A key feature of the Act, as you know, was the establishment of a system of fees, paid by the utilities, to fund the waste programs that are directly related to commercial nuclear waste disposal. We have long felt that the beneficiaries of nuclear power should bear the cost of disposing of the waste. This transition from

Government to commercial funding will impact the FY 1984 budget as offsetting revenues realized from fee collection are deposited in the Nuclear Waste Fund account. Programs not covered under the Waste Fund, such as Remedial Actions and the West Valley Demonstration Project, will remain a Federal funding responsibility.

Secretary Hodel has appointed Mr. Robert Morgan as the Director of the interim Nuclear Waste Policy Act Project Office and has detailed a sizable contingent of personnel to ensure that the near term legislated requirements are met. Preparations for establishing the office on a permanent basis are under way. I am confident that the Department will swiftly and effectively implement the Act. Mr. Morgan will be testifying regarding the details of the programs to be conducted under the Nuclear Waste Policy Act.

Included in the programs not covered under the Waste Act is the Department's responsibility for remedial actions at sites contaminated as a result of prior U.S. Government activities. Work is divided among four major programs. The Formerly Utilized Site Remedial Action Program (FUSRAP) has identified 35 sites throughout the country as requiring stabilization or removal of contaminated material. We are now performing the required work at the 14 sites for which DOE has remedial action authority. Our uranium mill tailings remedial action (UMTRA) program is directed toward the cleanup of 24 former processing sites and an estimated 5,000 to 6,000 vicinity properties contaminated by mill tailings from uranium mining and processing. A third program covers our participation in a Federal/State cooperative effort to remove uranium mill tailings used for construction purposes in Grand Junction, Colorado. At the close of FY 1984, we will have completed remedial actions at 612 of the 626 structures requiring attention. A fourth program manages and arranges for disposition of facilities formerly used for civilian nuclear energy development. About 80 sites are currently identified for work, including the Niagara Falls Storage Site, selected buildings at the Mound

Facility in Ohio, and the Shippingport Atomic Power Station. This program is developing improved technology and methods for facility decontamination and decommissioning (D&D) that will be of substantial benefit to industry in retiring nuclear plants from operation.

Finally, we are conducting a demonstration of high-level waste solidification at the Western New York Nuclear Center, near West Valley. After solidification technology has been developed, we will oversee the D&D of the West Valley facilities used in connection with this Project and will direct disposal of the resulting wastes. Our solidification work at West Valley is coordinated with our generic Waste Treatment Program, which is developing the waste package technology for repository disposal.

BREEDER REACTOR SYSTEMS

Our breeder reactor request for FY 1984 shows a slight increase over the FY 1983 appropriation. A substantial fraction of that request is for the Clinch River Project. I am well aware that support for this Project is far from unanimous but without rehashing the arguments for and against its continued funding, I would like to review briefly the historical breeder strategy that incorporates CRBR as a necessary element.

In 1967, when we concentrated our efforts on a single breeder technology--the Liquid Metal Fast Breeder Reactor--several alternative developmental strategies were considered. The strategy that emerged as having consistently the best potential for both safety and economics was to build a series of plants of increasing size that could demonstrate the critical elements of component and plant development. This scaleup approach was used to develop the light water reactor for commercialization. It has also been the strategy of choice for all other nations actively developing a breeder option.

Two reactors in the scaleup series--EBR-II and FFTF--have been built and are operating. The Clinch River Plant, which is the last step before building a commercial-size plant, is moving toward the construction stage. The plant design, which is at the forefront of technological advance, is approximately 90 percent complete. More than 70 percent of the major equipment and components have been delivered or are on order.

The licensing process, resumed in September 1981, is proceeding exceptionally well. Last August NRC granted our request to begin site preparation and in September work was initiated. We have completed the site suitability and environmental requirements for licensing and we expect NRC to issue its Safety Evaluation Report in March. NRC authorization to begin safety-related construction activities is expected by November of this year. Overall, CRBR licensing is moving at a faster pace than that of any light water reactor over the past five years. We believe this performance attests to the technological sufficiency of the plant design.

Despite these technical achievements, the Clinch River Project and, as a result, the entire breeder program are facing a critical juncture. The technology is close to commercial viability, but the financial resources necessary to complete CRBR are in question.

Clinch River was conceived as a joint venture between Government and industry with each bearing an equitable share of Project costs. The original industry financial commitment to CRBR funding was based on a cost estimate derived in 1972. Since that time, a combination of factors, including inflation and costly delays from Federal policy changes, have sharply escalated Project costs. The once equitable industry commitment is no longer sufficient to balance the large outlays that the Government must make to complete the Project. As you know, CRBR funding was provided for FY 1983 with a requirement for a vigorous exploration of possible methods of reducing Federal budget outlays. In response, the utility industry has established a task force of senior financial executives to prepare proposals for greater industry cost-sharing in the Project. Recommendations are to be forwarded to the Congress by March 15, 1983. It is my hope that the commitment of the private sector to the Clinch River Project is such that viable financing arrangements will be forthcoming.

CONVERTER REACTORS

The Converter Reactor Program is directed toward improvements in the Light Water Reactor technology and resolution of regulatory, financial, and institutional problems adversely affecting the nuclear industry. In the first instance, we are serving as the coordinator of a DOE/NRC/industry cooperative program to develop a systematic and integral approach to LWR safety. This responsibility was established by the Nuclear Safety Research, Development, and Demonstration Act of 1980. We are also participating in an international cooperative program to improve reactor response to accident conditions, making use of the unique capabilities of the Loss of Fluid Test (LOFT) facility. As an extension of our technical safety activities, we are cooperating with NRC, the Electric Power Research Institute and General Public Utilities in the cleanup of the damaged TMI-2 reactor. DOE's role is to accept unique radioactive waste, including the damaged core, for research and development of generic value to increased reactor safety and reliability.

Our role of assisting in the resolution of problems currently hindering the LWR industry is in response to the President's directive. We have prepared recommendations for licensing and regulatory reform that we believe will better serve the interests of, first and foremost, the general public; secondly, the regulators; and third, the industry which designs, constructs and operates nuclear power plants. We intend to submit legislation early in this session of Congress.

FUEL CYCLE PROGRAM

The technical objective of our Fuel Cycle Program is to develop advanced technology for reprocessing of fuels. Efforts are focused on the more stringent requirements associated with reprocessing of fast breeder reactor fuel which has higher thermal and radiation burdens, higher fissile content, and sodium contamination. This technology will also be available for future LWR fuel reprocessors.

We continue to feel strongly that reprocessed fuel has significant advantages over disposal of spent fuel on the basis of fuel conservation, nonproliferation, environmental, and economic considerations. As you know, the Continuing Resolution for FY 1983 instructed the Department to complete our safeguards evaluation at the Barnwell Plant and to phase out activities by July 31, 1983. Accordingly, we have requested no funds for Barnwell in FY 1984. We remain hopeful, however, that some private sector initiative will be forthcoming whereby this valuable commercial facility will be allowed to operate.

ADVANCED NUCLEAR SYSTEMS

The final program I would like to mention is our development of Advanced Nuclear Systems in support of U.S. military and civilian space missions. Since 1961, the United States has launched 22 NASA and military space systems having all or part of their power requirements supplied by nuclear power sources. These include the missions by Pioneer, Viking, and Voyager. We are currently developing nuclear isotope power generators for the NASA Galileo spacecraft and the NASA/European Space Agency spacecraft, both planned for launch in 1986. Another major activity is the development of space nuclear power reactors in cooperation with NASA and DOD.

SUMMARY

Mr. Chairman, in closing I would like to place the nuclear request for FY 1984 in perspective. It is important to remember that many of the programs are legislatively mandated and outside the scope of energy research and development. Examples are the Naval Reactor and Uranium Enrichment programs. When these are subtracted from the total request, there remains $837 million for energy supply R&D. Of that $837 million, $144 million is for noncommercial programs including waste management, remedial action responsibilities, and advanced nuclear systems activities in support of NASA and DOD missions. This leaves $693 million for fission energy R&D programs, i.e., breeder reactors, converter reactors, and the fuel cycle. These programs, which are ultimately intended for commercialization, are somewhat discretionary in character--that is, technologies that we are pursuing as a result of a conscious policy decision. The breakdown of funds is portrayed below:

	FY 1984 (in millions of $)
Total ASNE Budget	$1,450
Less:	
o Defense Activities (Naval Reactors)	-613
o Production Operations (Uranium Enrichment)	-2,240
o Revenue from Enrichment	+2,240
o Total Energy Supply R&D (Fission)	837
Less:	
o Waste Management	-16
o Remedial Actions	-94
o Advanced Nuclear Systems (Space)	-34
Programs Intended for Commercialization	693
o Breeder Reactors (CRBR)	-603 (270)
o Converter Reactors	-53
o Fuel Cycle	-37

I would like to point out that the $693 million requested for programs intended for commercialization represents only a 4 percent increase over the FY 1983 figure.

I recognize the difficult choices that Congress faces in its authorization and appropriation decisions. All programs have their attractive and supportable features and in more affluent times we could perhaps be less stringent in our funding selections. In view of the austere Federal budget, we have reexamined the nuclear program and have limited our efforts to activities that are sharply focused on a few critical objectives. We believe, Mr. Chairman, that the request we are presenting for FY 1984 is as lean as we can make it and still do the job.

I will now describe the elements of the fission program in detail.

URANIUM ENRICHMENT

The goal of the Uranium Enrichment Program is to meet domestic and foreign utility and United States Government requirements for uranium enrichment services in the most economical, reliable, safe and environmentally acceptable manner possible.

The FY 1984 budget request for the Uranium Enrichment Program is $2,240,000,000 for authorization and appropriation, offset by $2,240,000,000 in projected revenues.

Projection of Uranium Enrichment Requirements

The Office of Uranium Enrichment and Assessment periodically estimates the domestic and non-U.S. nuclear electric generating capacity that will be served by the United States uranium enrichment complex.

Our mid-range estimate made last summer projected online worldwide nuclear power capacity to be served by United States uranium enrichment capacity to be 135 gigawatts in 1985, 178 gigawatts in 1990 and 204 gigawatts in 1995. Domestic nuclear power capacity included in these totals are 87 gigawatts in 1985, 119 gigawatts in 1990, and 123 gigawatts in 1995. The domestic forecast is based only on reactors currently operating or under construction. Our total forecast estimate is lower than projected in last year's testimony by 2 gigawatts in 1985, 4 gigawatts in 1990 and 22 gigawatts in 1995. The reduced estimate reflects additional delays and/or cancellations of nuclear power projects.

Long-Term Strategy

A long-term production strategy is necessary to permit orderly planning to meet projected uranium enrichment requirements. The strategy is chosen after considering economics, operational risks, and the flexibilities that are available to respond to higher or lower demand levels. In the short term, the strategy calls for lower operating levels of the gaseous diffusion complex and reduced inventories of enriched uranium. Even though the lower operating levels result in the purchase of power below existing contract levels, requiring the Department to pay capacity charges to its power suppliers for power not purchased, it remains the most economical way to operate. Recently completed technical studies indicate that significant risk is incurred from prolonged plant operation below design levels. Accordingly, in FY 1984, the complex will operate at 3,190 megawatts or 530 megawatts above the FY 1983 level.

The strategy also calls for continued design and construction of the Gas Centrifuge Enrichment Plant (GCEP) at Portsmouth, Ohio. The GCEP will initially provide an additional 2.2 million separative work units (SWU) of capacity by 1989 with completion of two process buildings. Completion of the full GCEP (eight process buildings) will be based on either demand for additional capacity or the need to reduce production costs. As less costly gas centrifuge capacity becomes available, the more costly gaseous diffusion plants will be reduced, beginning in the early 1990's. Continued research on advanced gas centrifuge and the atomic vapor laser isotope separation technology provides additional cost reduction opportunities.

United States Competitive Position

At present, the demand for uranium enrichment is relatively static, future sales prospects are limited and uncertain, and many enrichment customers have purchase commitments far in excess of their needs. Some utilities are offering to sell their excess enriched uranium in competition with the primary enrichment suppliers rather than incur substantial inventory costs. This has created a substantial secondary market and corresponding near-term sales perturbations. As a result, a highly competitive situation exists between the primary enrichment suppliers for a fixed market volume. Today, we are facing competitive pressures in the United States and in the international market from several existing suppliers with the following production capacities:

Foreign Enrichment Suppliers and Capacity Levels

Supplier	Capacity (millions of SWU/Year)
Eurodif	10.8 capacity; current production is lower
Urenco	1.0 currently; 2.0 by 1990
USSR	3 currently available for export

In addition to these suppliers, Brazil and South Africa are constructing enrichment plants of modest size, primarily to meet indigenous needs. Japan has announced plans to build a 1 to 2 million SWU plant by 1990 using centrifuge technology in order to realize the announced goal of meeting up to 33 percent of their own enrichment needs. This could limit U.S. sales potential in Japan after 1990. Also, Australia has initiated a feasibility study based on Urenco technology for an enrichment plant which would be available in the mid 1990's. The realization of these enrichment plans will continue to intensify competitive pressures upon the United States.

Delays in nuclear programs, inflationary costs, and an economic slowdown worldwide have all contributed to excess enrichment commitments, large available utility-owned inventories, and associated financial burdens for the nuclear community. This situation, in combination with the pressures of a growing secondary market and aggressive actions by our enrichment competitors, has adversely affected the U.S. share of the enrichment market. In contrast to its previous position of being the sole supplier of enrichment services in 1974, the U.S. share of the non-U.S. market has declined to about 30 percent today. A number of our foreign customers have switched from the U.S. to Eurodif, Urenco and the USSR, and some new business has gone to these suppliers. During 1982, for the first time, a domestic utility terminated its contract with the U.S. in favor of a foreign supplier. To date, the total value of sales the U.S. has lost to foreign suppliers is over $2.0 billion, with about $0.5 billion in lost sales occurring during the last year. In addition to these losses, a great number of direct U.S. sales are being replaced by secondary market transactions. Though sales replacement by excess enrichment commitments originally produced by DOE is understandable, secondary market transactions of non-U.S. enriched material for use as a replacement for U.S. sales is occurring more frequently. Three U.S. utilities and three foreign companies replaced approximately $30 million of potential U.S. sales during 1982 with heavily discounted excess foreign origin enrichment material. All of these sale losses are of great concern to us, and we must reverse this trend.

Price has become the most important sales consideration to enrichment customers. The price advantage of $30 to $50 per SWU enjoyed by the United States in 1981 no longer exists. More and more frequently, both the secondary market and our competitors have offered price guarantees at levels below the U.S. price. Their pricing strategy and the fluctuating exchange rates have further aggravated the U.S. sales position. These competitive forces and large secondary market quantities have created market instabilities and significant sales uncertainties for the U.S. enrichment business. The United States is faced with the need to compete in a highly unstable, low price enrichment market while at the same time financing the capital investments needed to implement advanced, low cost technologies that are vital if the United States is to maintain a market leadership position in the future.

We are taking a number of actions to enhance the market position of the U.S. uranium enrichment program. We are minimizing the current selling price by reducing costs and optimizing enrichment production activities. We are developing a new enrichment contract, the Facility Requirements (FR) contract, to provide needed stability between enrichment commitments and actual requirements by offering greater contract flexibility to customers. Finally, we are developing advanced, low cost technologies and deploying them on a schedule designed to make the most economically attractive enrichment services available to U.S. customers in the post 1990 time period. If successful, these steps will maintain and eventually expand the U.S. sales base, thereby enabling significant benefits in terms of domestic employment, balance of payments and a meaningful contribution to nuclear policies abroad.

Uranium Enrichment Activities

The budget for Uranium Enrichment Activities as shown in Chart 1 provides funding for three major program activities: (1) Gaseous Diffusion; (2) Gas Centrifuge, and; (3) Advanced Isotope Separation.

CHART 1

URANIUM ENRICHMENT PROGRAM

	Budget Authority (Dollars in Thousands) FY 1983	Budget Authority (Dollars in Thousands) FY 1984
Uranium Enrichment Activities		
Gaseous Diffusion		
Cascade Power	884,000	$ 1,184,000
Other Operations and Support ...	316,353	297,300
Total Gaseous Diffusion	1,200,353	1,481,300
Gas Centrifuge		
GCEP	588,000	572,000
Other Operations and Support	94,500	109,800
Total Gas Centrifuge	682,500	681,800
Advanced Isotope Separation ...	50,633	73,000
Program Direction	3,650	3,900
Total Uranium Enrichment Activities	$ 1,937,136	$ 2,240,000
Uranium Resource Assessment	5,000	0
Subtotal	1,942,136	2,240,000
Uranium Enrichment Revenues	-1,968,319	-2,240,000
Total, Uranium Enrichment Program	$ -26,183*	$ 0

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* The net FY 1983 appropriation, after revenues, is $0. The number shown reflects comparability adjustments.

Gaseous Diffusion

The United States presently enriches uranium to the desired U-235 product assay in the gaseous diffusion plants located at Oak Ridge, Tennessee; Portsmouth, Ohio; and Paducah, Kentucky. In these plants, the United States enriches customer-provided natural uranium in the U-235 component for a fee which recovers the cost of providing the services.

In FY 1984, $1,481,300,000 is requested for operation of the gaseous diffusion complex. The three gaseous diffusion plants will operate at a power level of 3,190 megawatts in FY 1984 and produce about 12.1 million SWU. The FY 1984 operating level is consistent with our long-term enrichment strategy and represents an increase of 530 megawatts above the FY 1983 level of 2,660 megawatts. Recent technical studies indicate that prolonged operation below 3,190 megawatts would run a significant risk of extensive equipment failures. This could result in the loss of plant capacity and the release of radioactive material.

The 3,190 megawatt power level is substantially below the 5,781 megawatts we are contractually committed to purchase under existing contracts with the three power suppliers. Consequently, we are contractually required to pay about $243,000,000 in capacity charges in FY 1984 (Tennessee Valley Authority (TVA)--$226,000,000, and Ohio Valley Electric Corporation (OVEC)--$17,000,000) for power under contract that will not be purchased. If the Department purchased power at the contractually committed level of 5,781 megawatts, the FY 1984 power budget would be increased by $680,000,000 from $1,184,000,000 to $1,864,000,000.

We are continuing discussions with the power suppliers in an attempt to reduce the capacity charge payments for power not purchased. As in the past, the success of these negotiations depends on the ability of our power suppliers to transfer contract power not purchased by the Department to other customers.

Relief from OVEC for FY 1984 is heavily contingent upon the level of economic activity in the Midwest. Relief from TVA is unlikely at this time because of the surplus generating capacity within TVA's own system, as well as within neighboring systems.

The total FY 1984 cascade power budget, including $226,000,000 in TVA capacity charges, is $1,184,000,000. This is an increase of $300,000,000 over the FY 1983 budget and is due to the purchase of the additional 530 megawatts, increases in the cost of power purchased and increased capacity charges for power not purchased.

Funding requested for diffusion operations, process and long-range technical support, supporting services, capital equipment and construction is $297,300,000. This is a net decrease of about $19,100,000 from the comparable FY 1983 budget. The major decreases are in the requirements for capital equipment and line item construction projects. The only budget increase is in the plant operations account primarily related to existing labor agreements. The requested funds are the minimum amounts needed to operate the plants; to replace equipment that has exceeded its useful life; to properly maintain the plants; and to comply with environmental and safety standards.

New construction projects for the gaseous diffusion program include: storage yards and cylinders for UF_6; general plant projects; utilities upgrading; intermediate gas removal; and power systems protection improvements.

Funding is also requested to continue projects authorized in previous fiscal years.

Gas Centrifuge

The FY 1984 budget request contains $572,000,000 for the construction of GCEP and $109,800,000 for other centrifuge activities.

The GCEP will provide an additional 2.2 million SWU per year of capacity by 1989. This GCEP capacity will be increased to

3.3 million SWU per year through upgrading with advanced gas centrifuge machines now being developed; even further advancement in centrifuge machines now appears achievable.
DOE continues to support the need for GCEP based on the results of the Department's thorough analyses of the alternatives available to the enrichment enterprise. These analyses carefully examine various production scenarios and evaluate the merits of each on the basis of cost, both to the Government and to the customer; impact on U.S. enrichment prices and our competitive position in the international market; energy efficiency; and technical achievability. Construction of GCEP will yield superior benefits both to the Government and its customers in terms of improved economics and production reliability. Even at reduced demand levels, the cost of production from GCEP in current year dollars will be significantly lower than production from the existing electricity intensive gaseous diffusion plants (GDPs). When escalation is factored in, the difference between GCEP and GDPs becomes very large.

The rapid deployment of enrichment technologies capable of reducing U.S. production costs is a necessary and prudent business decision. Our centrifuge technology is the most advanced proven enrichment technology in the world and offers the U.S. the opportunity to halt the erosion in our existing enrichment contract base and to regain its leadership and market share in the international nuclear community. The Advanced Gas Centrifuge and the Atomic Vapor Laser Isotope Separation technologies currently under development by the Department offer the promise of even lower future costs but must reach a more mature stage of development before they can be counted on for production planning.

We have emphasized to all existing and potential customers that appreciable cost reductions are expected in the U.S. enrichment program by virtue of U.S. leadership in and utilization of advanced enrichment technologies. Our customers universally accept the concept that future enrichment prices will be more favorable with the incorporation of the more economical, less energy intensive centrifuge technology being installed in GCEP.

Without GCEP, U.S. enrichment prices will be perceived by our customers as being significantly higher in the future. This fact has been emphasized by our competitors, Eurodif and Urenco. Our competitors stand to gain a considerable market advantage if the potential of GCEP is not realized in the U.S. Though a detailed estimate of potential sales losses is not possible, the continued strength and vitality of a U.S. Government enterprise which produces $2 to $3 billion in annual revenues, of which about one-third represents a positive contribution to the U.S. balance of payments position, is a worthwhile consideration. In this regard, the commitment to building GCEP is a major positive force.

GCEP is making excellent progress and is on schedule with the total estimated cost (adjusted for escalation) constant. Project momentum continues at a high rate as construction progresses. Process Buildings No. 1 and No. 2 are enclosed. In Process Building No. 1, the floor modules for the centrifuge machines and electrical, heating and ventilation systems are installed. Process piping is under contract and installation is proceeding. Site preparation and rough grading for all eight process buildings is complete. The Recycle/Assembly Building is enclosed and a portion of the building has been turned over to the operating contractor. The fire station, central receiving warehouse, mobile equipment garage, the administration building, electrical substations, and several support buildings are finished. Work on the central control room, the Feed and Withdrawal Building and utilities is underway. Through FY 1983, $2,173,520,000 has been authorized and $2,127,845,000 appropriated, with costs of $1,811,493,000 against a total estimated project cost of $7,450,000,000 in FY 1984 dollars. Design of the GCEP Project is over 89 percent complete with seven of the nine major architect engineers having finished their design efforts. Three centrifuge machine manufacturers have constructed and are operating manufacturing facilities in Ohio and Tennessee using corporate funds. All of the centrifuge manufacturers are now fabricating centrifuge machines on production tooling. Centrifuge machines are operating in the Life Test Facility and the Centrifuge Plant Demonstration Facility (CPDF). The CPDF is a full cascade which will be replicated many times in GCEP. Other manufacturing facilities for materials and components for the GCEP project are in place and in production.

In August of 1982, the CPDF became operational with industrially supplied centrifuges. Start-up, operation, and performance of the machines to date have exceeded all expectations in terms of machine reliability and capacity. The balance of plant equipment operation has been equally successful.

The FY 1984 request for other centrifuge operations and support includes funds for startup testing, procedures, and training to support operation of the GCEP. Also included are funds for the Advanced Gas Centrifuge development program, capital equipment and construction. The FY 1984 budget request for these activities is $109,800,000, an increase of $15,300,000 over FY 1983. Costs for GCEP startup activities are increasing by $21,700,000 over FY 1983 and developmental activities are decreasing by $6,400,000. The increase in startup activities reflects the testing of subsystems, preparation of operating and maintenance procedures, and personnel training. These activities are required in order to begin in-plant operational testing in mid-FY 1984, and to assure that Process Building No. 1 becomes partially operational by FY 1985.

The Advanced Gas Centrifuge (AGC) program consists of projects intended to provide production centrifuges with separative capacity substantially greater than the baseline (Set III) centrifuge. The Department is making good progress in demonstrating an advanced centrifuge, designated Set IV, which has separative capacity 1.5 times that of Set III. Efforts, to date, have verified that the speed and improved flow management techniques extrapolated from current technology have the potential of providing the anticipated performance gain. Full-scale centrifuge tests in this program during FY 1983 will establish which design features will optimize overall separative performance and achieve the desire 50 percent improvement.

In early FY 1983, we initiated research and development on a gas centrifuge concept with a potential separative capacity 2 to 3 times greater than the baseline centrifuge. Gas centrifuges developed within this effort are designated as Set V. A key feature of this program is the relatively high payoff it offers for a modest investment. We anticipate that the first phase, which covers two years, will encompass preliminary testing of full-scale machine rotors intended to verify that reliability testing and production design are warranted.

Advanced Isotope Separation

The objective of the Advanced Isotope Separation (AIS) program is to develop and implement a process that has the capability of producing enriched uranium at costs of less than $40 per SWU. In April 1982, the Atomic Vapor Laser Isotope Separation (AVLIS) process was chosen from three competing AIS technologies to proceed to the engineering development phase. The selection of AVLIS resulted from comprehensive technical evaluations of each technology. These evaluations included a risk assessment and an identification of the major technical uncertainties to be resolved prior to the initiation of the detailed design of large scale facilities. For AVLIS technology, the principal uncertainty involved the operability of the uranium collector subsystem. The FY 1983 AVLIS development effort will extensively examine this issue by operating existing testbeds. The goal of this effort is to develop the data base needed to design plant scale testbeds. Efforts will proceed to complete partially constructed testbeds, such as the Materials Handling Development Module (MHDM) which, when operated, will provide a validation of the FY 1983 data base at near plant scale geometries. Experiments will be conducted on enrichment demonstrations using the updated baseline feed and liquid collection of product and tails. Also we intend to complete a new point design using an updated feed concept.

The major AVLIS effort in FY 1984 will be to complete the detailed data package needed to proceed with engineering design and to initiate construction of experimental facilities capable of demonstrating the process at full scale. Technology development funds are also required to provide the information needed to initiate fabrication of the next generation of laser and separator subsystems. In addition, MHDM will become operational at the end of FY 1984. This facility will be used to demonstrate the thermal management of collector subsystems in MHDM. The FY 1984 funding requested for the AVLIS program is required to initiate evaluation of subsystem reliability, lifetime and engineering issues.

Uranium Resource Assessment

Although the data collection portion of the National Uranium Resource Evaluation (NURE) program was terminated in FY 1981, during FY 1982 a tremendous amount of the data were analyzed and made available to the public in reports, maps, and computer tapes. During FY 1983, essentially all of the remaining data gathered through the NURE program will be made available to the public. Thus, the major goals of this program have been achieved.

COMMERCIAL WASTE MANAGEMENT PROGRAM

The elements of the Commercial Waste Management Program include Remedial Action, the West Valley Demonstration Project, Commercial Low-Level Waste, and Waste Treatment. I will also discuss the Three Mile Island Program which is funded under the Converter Reactor Program but managed under the Commercial Waste Management Program.

Remedial Action Program

The objective of the Remedial Action program is to treat or stabilize radioactive wastes and perform required decontamination and decommissioning at contaminated DOE and legislatively dictated non-government facilities and sites. The major program areas are: (1) Formerly Utilized Sites Remedial Action Program (FUSRAP); (2) remedial action at Grand Junction, Colorado (P.L. 92-314, as amended); (3) Uranium Mill Tailings Remedial Action Program (UMTRAP) for inactive uranium mill tailings sites (P.L. 95-604); and (4) management of certain radioactively contaminated Department facilities declared surplus and resulting principally from civilian nuclear energy programs.

The FY 1984 budget request for the Program is $93.98 million as compared to a FY 1983 appropriation of $63.39 million. This also includes funds for the West Valley demonstration of the solidification of high-level radioactive wastes for final disposal (P.L. 96-368).

Formerly Utilized Sites

The Formerly Utilized Site Remedial Action Program (FUSRAP) provides for remedial actions at former nuclear processing facilities, most privately owned, which became radioactively contaminated from Manhattan Engineer District or Atomic Energy Commission activities and which have not been decontaminated sufficiently to meet current health effects guidelines for unrestricted use. Potential health risks limit the utilization of these properties, and property values may in some cases be reduced. To remedy the situation, the contamination will be either stabilized in-place, with restrictions placed on site use, or the contamination will be removed and disposed of at another location. Thirty-five sites have been identified as potentially requiring remedial action. DOE has remedial action authority at 14 sites. Only minimal activity, limited to some preliminary engineering and environmental studies required for planning, will be carried out for non-authorized sites. At sites where remedial action is undertaken, stabilization in place will be the preferred option. Where removal of the contamination is necessary, DOE sites will be utilized for the disposal of small quantities of contaminated material. In other cases, the affected State would be expected to select a new disposal site to be owned by either the Federal or State government. The Oak Ridge Operations Office has the lead field office role in implementing this program.

In FY 1983, the remedial actions begun in FY 1982 at Bayo Canyon and on the upper part of Acid Pueblo Canyon, Los Alamos, New Mexico, have been completed. Remedial action to clean up the main drainage ditches from the Niagara Falls Storage Site (NFSS) in New York will be completed.

Design engineering will be initiated for remedial action at the Shpack, Massachusetts landfill; at Middlesex, New Jersey municipal landfill; and at Linde Air Products in Tonawanda, New York. Preliminary engineering will be completed for the remedial action at the DuPont Deepwater, New Jersey plant.

In FY 1984, design engineering and NEPA documentation will be completed at Linde Air Products in Tonawanda, New York; DuPont in Deepwater, New Jersey; and Middlesex Landfill and Middlesex Sampling Plant Phase III in Middlesex, New Jersey.

Grand Junction

Under Title II of Public Law 92-314, Congress authorized financial assistance to the State of Colorado, to limit radiation exposure resulting from the use of uranium mill tailings for construction purposes in Grand Junction, Colorado. This State/Federal cooperative effort with the State of Colorado is administered by the Colorado Department of Health through the Grand Junction Area Office. The remedial action provides for removal of uranium mill tailings from the premises of about 626 structures where radon daughter exposures exceed the Surgeon General's guidelines. Public Law 95-236 extended the time for property owners to apply for inclusion in the program (which has now expired), and increased authorized program funding. Federal funds cover 75 percent of the program costs with the State providing the balance. FY 1985 is expected to be the last year Federal funds will be requested for the program. The Grand Junction Office administers this program. Through FY 1982, work had been undertaken at 472 structures including 400 residences, 12 schools, and 60 nonresidential structures. In FY 1983 the program will continue with radiological assessments and will initiate remedial actions at about 70 structures. In FY 1984, the program will complete remedial actions on 70 structures for a total of 612 structures out of a total of 626 to be completed.

Uranium Mill Tailings

The Uranium Mill Tailings Remedial Action (UMTRA) program is responsible for conducting remedial actions at 24 sites and an estimated 5,000-6,000 vicinity properties mandated by Public Law 95-604, "The Uranium Mill Tailings Radiation Control Act of 1978." Nine of the sites are designated as high priority, six as medium priority, and nine as low priority. The Act requires completion of the program within seven years of promulgation of standards by EPA, which were issued in December 1982. An evaluation is now ongoing to assess the feasibility and budget impact of the mandated 7-year schedule. After completion of the evaluation, an amendment to P.L. 95-604 may be offered to extend the period of DOE's authorization so the completion of the project can be accomplished in a more cost effective manner. Remedial actions will be conducted in accordance with cooperative agreements negotiated with the affected States and Indian tribes. Federal funds are to cover 90 percent of the remedial action costs (100 percent for those sites on Indian lands). The type of remedial action for the processing sites will be either to stabilize the mill tailings in-place, where feasible, or to remove the tailings to a new federally-owned disposal site. The program also includes the cleanup of properties in the vicinity of the processing sites which have become contaminated with radioactive material derived from the sites. It is estimated that from 5,000-6,000 vicinity properties--mainly in the Grand Junction area, but not authorized by the Grand Junction program--may be found eligible for cleanup. Engineering plans and environmental documents will be prepared for the cleanup and disposal operations at each site. The concurrences of the Nuclear Regulatory Commission (NRC) and the affected State (or Tribe) are required for each site remedial action plan.

Specific accomplishments planned for the balance of FY 1983 include the continuation of high priority remedial actions at vicinity properties near the Canonsburg, Salt Lake City, and Grand Junction sites and completion of detailed remedial action plans for four high priority sites (Canonsburg, Salt Lake City, Gunnison and Shiprock). In FY 1984, the program will complete NEPA work and initiate remedial action at these four high priority processing sites.

Surplus Facilities

This program provides for the safe management and disposition of the inventory of surplus Department-owned facilities that have been radioactively contaminated from civilian nuclear energy development programs. The decontaminated facilities and sites are returned to other productive use where appropriate. All defense-related DOE facilities are included in the Defense Nuclear Waste Management Budget. About 80 facilities are currently identified under this civilian activity. In addition, the program develops improved methods for decontamination and decommissioning which can be transferred to industry. A long range plan will be completed in FY 1984 to establish an overall schedule and priorities for sites currently in the surplus inventory. The Richland Operations Office has the lead field office role in implementing the program.

In FY 1983, the on-site activities at the Niagara Falls Storage Site will be accelerated with the goal of completing all interim work in early FY 1984. This will complete the impoundment of uranium residues and contaminated soils which are now in exposed or poor storage conditions in a new improved storage area, thereby assuring no further occurrence of off-site contamination and compliance with the State of New York requirements for radioactive effluent control. The engineering, design and planning phases of the Shippingport Decommissioning Project will be completed in FY 1983. The decommissioning operations at the Mound Facility, Ohio in the Plutonium Processing and Research Buildings will be continued, and the removal of the Waste Transfer System will be started. This work is being carried out as part of a joint project with Defense Programs, with total project completion planned for FY 1988 at a total cost of about $64 million. The project will be 50 percent completed at the end of FY 1983.

In FY 1984, interim actions at the high priority Niagara Falls Storage Site will be completed and substantial progress will be made at other high priority sites. The work at the Mound Facility will reach 60 percent completion. The remedial action program will assume responsibility for the Shippingport Atomic Power Station from DOE-Naval Reactors in late 1984 after defueling and shipment of the fuel to Idaho is completed. During the third quarter of FY 1984 a decommissioning contractor will be brought on board to participate with DOE-NR contractors in plant shutdown and maintenance. Preparations for start of the Decommissioning Project will be completed in FY 1985. Current projections are that D&D of the Shippingport plant will take approximately 3 1/2 years and cost approximately $67M.

Field work at the Weldon Spring, Missouri Site will include start of the stabilization test of pit No. 4; a draft environmental impact statement will be completed for the residue storage pits and the quarry; design engineering will be started for long-term actions at this site.

Radiological Survey and Certification Activities

To promote further efficiency, the Radiological Survey and Certification Activity responsibilities relating to the Remedial Action Program were transferred from the Office of the Assistant Secretary for Environment, Safety, and Emergency Preparedness to my office in January 1983. These activities, funded in FY 1983 at $3.7 million, will be absorbed in the Remedial Action Projects.

West Valley Demonstration Project

The objective of the West Valley Project is to demonstrate solidification for disposal of high-level nuclear wastes under the provisions of Public Law 96-368, the "West Valley Demonstration Project Act". The project will carry out integrated production-scale development and demonstration of the treatment of the high-level liquid nuclear wastes at the Western New York Nuclear Center.

Major activities to be performed as part of the project include: (1) necessary decontamination required to prepare existing facilities and equipment at the Center to accommodate the solidification project; (2) removal of the wastes from the underground storage tanks; (3) development, design, construction and operation of systems and necessary supporting facilities for the solidification of the wastes; (4) acquisition of containers for the permanent disposal of the solidified waste; (5) temporary storage and transportation of the solidified waste to an appropriate Federal repository for permanent disposal; (6) decontamination and decommissioning (D&D) of the waste tanks, facilities, hardware, and material used in carrying out the project; and (7) disposal of low-level and transuranic wastes produced from project activities.

The CY 1982 program emphasized site takeover and initiation of project activities. This year the development of definitive solidification and decontainment plans for carrying out the project is receiving priority attention. With the planning, scoping, characterization, and baselining efforts completed in

FY 1983, the FY 1984 program will implement these plans with major emphasis in waste solidification development and design, and decontamination and decommissioning.

Our recent major accomplishments in CY 1982 included:

- o Site takeover; issued final Environmental Impact Statement, and Record of Decision.
- o Made first manned entry into hot cell.
- o Inspected and sampled waste storage tanks.

The FY 1983 program includes the following critical activities:

- o Complete waste process and form selection.
- o Complete solidification conceptual design.
- o Complete decontamination of crane room and work plans and procedures for next four hot cells.
- o Commence construction of vitrification equipment component test stand.

In FY 1984 we plan to accomplish the following:

- o Complete preliminary (Title I) design of high-level waste solidification equipment and facilities.
- o Complete procurement of equipment items for waste solidification component test stand.
- o Complete decontamination of four hot cells and work plans and procedures for five more hot cells.
- o Initiate procurement of LLW/TRU sorting facility and LLW volume reduction equipment.

Low-Level Waste

Public Law 96-573, the Low-Level Radioactive Waste Policy Act, assigned States the responsibility for assuring disposal capacity for commercial low-level radioactive waste (LLW) generated within their borders. The formation of regional compacts to satisfy this responsibility was encouraged by the law. The goal of the Department's LLW program is to assist states in the development of an effective national LLW management system by 1986 and to evaluate this system in terms of operational efficiency by 1988.

During FY 1983, the Program will complete the development of the regional LLW data base, and continue State/regional technical and financial assistance in support of P.L. 96-573.

The LLW program in FY 1984 will primarily provide technical and financial assistance to States and regions to support selection and operation of new LLW disposal facilities by 1986 (primarily through regional compacts).

Waste Treatment

The objective of this program is to develop and demonstrate technologies for the treatment and immobilization of nuclear fuel cycle radioactive wastes in forms acceptable for transportation, storage and ultimate disposal. Specifically, high-level waste, transuranic waste, and sodium contaminated wastes are addressed. Over the years, methods for treating high-level and transuranic wastes have been developed. This program is now focused on determining the long-term reliability and maintainability of improved prototypical waste treatment systems, on testing and selecting acceptable waste forms for storage or permanent disposal in licensed facilities, and on demonstrating the adequacy of these technologies through their application to specific Departmental waste treatment efforts such as those at West Valley and Three Mile Island (TMI). Activities in this program are coordinated with other Departmental efforts related to fuel reprocessing, generation of special wastes, transportation, and terminal isolation of Department and commercial wastes.

In FY 1983, the performance requirements and specifications for high-level (main focus) and transuranic waste forms and their containers will be developed. The adequacy of a glass waste form to meet these performance requirements will be examined. A reference waste form for commercial high-level wastes will be selected. In the waste immobilization area, emphasis will be on the latest technology for waste vitrification, the liquid fed ceramic melter. Improvements will be made in performance of the melter feed, off-gas and waste glass canister treatment systems. Preparation for development and evaluation of a waste form alternative to glass will also be undertaken.

In FY 1984, waste solidification activities will focus on vitrification process controls and quality verification methods for demonstrating that the glass waste products meet the required specifications developed in FY 1983. Specifications for transuranic wastes will be completed in FY 1984, and development of transuranic waste treatment processes will continue in preparation for future demonstration of these techniques on actual wastes. The sodium treatment facility will be converted to handle radioactive materials and will process contaminated sodium from the Experimental Breeder Reactor-II (EBR-II) operations utilizing the system demonstrated in FY 1983. Criteria and guidance for shallow land burial of sodium contaminated wastes will be tested and completed.

Three Mile Island Program

The Three Mile Island (TMI) program is funded under the Converter Reactors program but is managed and will be discussed under the Commercial Waste Management program. The objectives of the TMI program are (1) to acquire information and conduct R&D that will substantially enhance nuclear powerplant safety, reliability, and operation, and (2) to improve the technology and pro cedures for safely disposing of abnormal nuclear wastes resulting from an accident.

In consonance with the Administration's policy of private sector responsibility for commercial nuclear power activities, the Department's TMI program is limited to research and development that will be of overall value to the development and safety of nuclear power and waste management. Responsibility for the costs of TMI cleanup remains with General Public Utilities (GPU), the owner of the facility.

The TMI activities are being implemented in accordance with a memorandum of understanding by DOE, NRC, the Electric Power Research Institute (EPRI), and GPU. The efforts of GPU are aimed at plant cleanup and recovery. The Department has developed a program work scope that enables obtaining important R&D information that would not otherwise be available from the TMI-2 cleanup effort. The DOE program is being conducted in a manner that avoids delaying the GPU cleanup schedule.

In accordance with a Memorandum of Understanding between the DOE and the Nuclear Regulatory Commission, the Department will acquire unique radioactive waste, including the damaged core, from TMI for research and development and for disposal.

Two subprograms compose the TMI program: the TMI Data Acquisition Program and the TMI Waste Immobilization and Reactor Evaluation Program. The FY 1984 budget request for this program is $37 million as compared to $29 million in FY 1983.

TMI Data Acquisition Program

The objective of this subprogram is to obtain R&D data of generic value to the safety of light water reactors.

The DOE and EPRI are sharing responsibility and costs for portions of this R&D program. Specifically, the Department is funding data gathering, research and development, and information transfer in the following major areas: instrumentation and electrical equipment survivability, behavior of radioactive products, data system and specimen achieving, and offsite fuel debris examination. EPRI has responsibility for mechanical and structural component reliability, pressure boundary recharacterization, and decontamination and dose reduction associated with the primary coolant system.

During FY 1983, the analysis of the hydrogen burn event in the TMI-2 containment will be completed and the results provided to NRC and industry for use in calibrating their analytical techniques. Technology transfer activities in the instrumentation programs will be emphasized. Techniques to requalify electrical cables in-situ will be developed.

In FY 1984, DOE plans to conduct the in-situ and offsite examination of selected instrumentation and electrical components to ascertain their condition, cause of failure, and features which affect equipment survivability. Data obtained will be used to upgrade standards and guides, resulting in improved equipment for surveillance of nuclear plants. Efforts will continue on analyzing samples to identify how various radioactive isotopes, released within the containment building during the accident, were transported and deposited. These data will be valuable in assessing the existing models for fission product release which are used in nuclear powerplant licensing. Preparation for the offsite examination of fuel debris will be continued but actual examination will not begin until after defueling starts in 1985. The computer data bank system will continue to collect, store and transfer to NRC and industry the data and documentation generated by the Department's program.

TMI Waste Immobilization and Reactor Evaluation

The objectives of this subprogram are: (1) to conduct research and development on immobilization of abnormal reactor waste products, and (2) to examine the TMI-2 reactor and core components in-situ and to support development activities associated with the reactor defueling. The data acquired will provide an improved basis for evaluation of licensing criteria and requirements, analysis of causes and consequences of accidents, and improvement of reliability of the design and operation of LWR's. This program element was initiated in FY 1982.

The waste management and immobilization activities are initially being focused on an effort to demonstrate the feasibility of vitrifying zeolite ion exchange materials. The program will have demonstrated this feasibility in FY 1983.

Beginning in FY 1983 and continuing in FY 1984, this subprogram will focus on other techniques for the treatment of abnormal wastes produced at TMI, including alternative immobilization concepts for inorganic ion exchange zeolites and organic resins, confidence testing and long term sample observation to provide a more extensive data base. Some of the areas which will be addressed include demonstration of liner disposal in a high integrity container, resin solidification and lysimeter testing.

The reactor evaluation activities include examination, removal, and disposition of the reactor core and internals. The special systems, equipment, facilities, and processes needed to accomplish the defueling operation, including examinations, tests, and evaluations of the fuel, will be developed.

To date, over 170 manned entries have been made into the reactor to determine both the extent of damage and the resulting program requirements. Principal efforts will be directed to the goal of removing the reactor head late in FY 1983. In parallel, the development and engineering of systems, equipment and procedures for reactor plenum removal and storage and for reactor defueling and fuel transfer will be initiated. In FY 1984, plenum removal will be accomplished and core disassembly activities will begin. Work will be directed toward preparing for a thorough examination of the reactor internals and core and performance of defueling activities in a radiation environment as low as practicable. Substantial beneficial data on the condition of the reactor core and other internal components will be obtained. In addition, preparations will be made for extensive off-site examinations of the fuel, debris and reactor internal components to characterize the accident effects.

This program will provide the data required for evaluating present licensing criteria and requirements; developing future licensing criteria; assessing and developing computer models used to analyze the course and consequences of severe accidents; developing means to mitigate the effects of such accidents; and evaluating improvements to reactor design, operation, and maintenance.

BREEDER REACTOR SYSTEMS

The objective of the Breeder Reactor Systems program is to complete the research and development of the breeder technology to the stage appropriate for transfer to industry. Ultimately the private sector--nuclear reactor vendors, other suppliers, architect/engineers, and utilities--has responsibility for plant investment and commercialization decisions. The major thrust of programmatic activity is directed toward the Liquid Metal Fast Breeder Reactor (LMFBR). A smaller, complementary effort is directed at the Water Cooled Breeder. The breeder reactor systems funding request for FY 1984 is $602.5 million as compared to $549.9 in FY 1983. Distribution of the funds is as follows:

	FY 1983 (in thousands)	FY 1984 (in thousands)
Breeder Reactor Systems		
Liquid Metal Fast Breeder Reactor	$496,829	$556,825
Water Cooled Breeder	44,984	35,500
Program Direction	8,061	10,200
Total	$549,874	$602,525

Liquid Metal Fast Breeder Reactor Program

The LMFBR program consists of a streamlined research and development effort aimed at private sector industrial deployment. The program consists of three broad elements: (1) construction and operation of the Clinch River Breeder Reactor Plant (CRBRP), and cooperative planning for a follow-on, large-size prototype breeder to be financed, constructed, and operated primarily by the private sector; (2) a supporting base technology program, including test facility construction and operation and technology research and development efforts in reactor fuels, components, physics, and safety; and (3) a supporting fuel cycle program (funded separately).

The first two elements are closely integrated and are directed at breeder powerplant development, while the fuel cycle effort provides the basis for integrating breeder reactors into an existing and expanded nuclear energy economy. The focus of the breeder program is the development of an economically competitive breeder that is inherently safe.

Clinch River Breeder Reactor Plant Project

The overall objective of the CRBRP project is to design, construct, and test the nation's first intermediate scale (375 megawatt electric) LMFBR powerplant and operate the plant as part of a utility system. The project is a joint undertaking of the U.S. Government and 753 electric systems from the public, private, municipal, and cooperative sectors of the utility industry. Its size represents a technically significant yet prudent scaleup in plant technology. The construction site for the CRBRP is located in Oak Ridge, Tennessee, where it will operate as part of the TVA electricity supply network. In addition to fulfilling its principal objective of advancing breeder technology, the plant will produce electrical power sufficient to meet the needs of 200,000 people.

The importance of this project is widely recognized. President Reagan in his October 8, 1981, policy statement on nuclear power stated that completion of the Clinch River plant "is essential to ensure our preparedness for long-term nuclear power needs." The CRBRP will provide valuable technical information from the results of the plant design; fabrication of plant components; and plant safety, licensing, construction, and operating experience.

The CRBRP project is presently authorized under Public Law 91-273, as amended. Under the law, Congress authorized the Agency to enter into a definitive cooperative arrangement for an LMFBR plant. The cooperative arrangement, called the quadripartite contract, between the Agency, Project Management Corporation

(PMC), Tennessee Valley Authority (TVA), and Commonwealth Edison (CE) has been in effect since 1973.

In the last Congress, CRBRP was subject to a wide ranging debate. Funding for the CRBRP was provided for FY 1983 with a requirement for a vigorous exploration of possible methods for reducing Federal budget requirements. In response, the utility industry has established a task force of senior financial executives to prepare proposals for greater industry cost-sharing in the project. A Department of Energy recommendation and the task force report will be forwarded to the Congress by March 15, 1983.

At the same time, following authorization from NRC, site preparation has been proceeding for several months, and plant design, hardware procurement, and licensing activities are now well advanced. By the end of FY 1983, about $1,600,000,000 will have been spent on these activities ($1,450,000,000 in Government funds and $150,000,000 in utility and other contributions). The net remaining cost to the Government to complete the project is approximately $2,000,000,000. This amount would be reduced by increased utility industry financing.

The Clinch River Plant design has been updated continuously and reflects current regulatory requirements and new breeder developments in the United States and abroad; it is at the forefront of world breeder technology.

Important actions and accomplishments realized to date include: (1) receipt of NRC authorization pursuant to 10 CFR 50.12 to conduct site preparation activities; (2) completion of site suitability and environmental hearings; and (3) issuance by NRC of the Site Suitability Report and the Supplement to the CRBRP Final Environmental Statement--both of these documents contain findings favorable to the project. Continued progress in the licensing area is expected to lead to NRC authorization in FY 1983 to begin safety related construction activities in early FY 1984.

Other aspects of the project are well advanced. By the end of FY 1983, design of the plant will be near completion; about $750,000,000 of the hardware required for the plant will be on order or delivered; hardware deliveries alone will be valued at approximately $406,000,000. Consistent with NRC's authorization, site clearing and excavation will continue during FY 1983.

Planned activities during FY 1984 include further licensing activities, completion of site preparation, and initiation of construction of permanent plant structures. Continued progress will be made in the fabrication of hardware. Component completions planned for FY 1984 include the polar crane, the service building bridge crane, the upper internals structure, the radwaste solidification system and the air blast heat exchanger. In addition, substantial progress will be made on fabrication of other plant hardware, including the plant steam generators and pumps.

Our confidence in the ability to complete the plant in a cost effective and timely manner is based on the advanced state of its design, the advanced completion of hardware, the testing of prototype equipment, and the licensing and research and development being done.

Large Scale Prototype Breeder

The technical and economic uncertainties of proceeding to a commercial-size demonstration of a large breeder reactor are understandably unreasonable for the private sector to bear alone at this time. The intermediate-size CRBRP and the breeder base technology program are directed at reducing these technical and engineering uncertainties to acceptable levels whereby the private sector could take the lead for the next major plant project. The design, construction, and operation of a large developmental breeder plant at near-commercial size will provide further confirmation that these risks are at an acceptable level to private industry.

The U.S. Government and private industry are cooperating to establish institutional and financial arrangements, and to develop implementation plans for proceeding with the design, construction, and operation of a near-commercial-size breeder. Ultimately the effort is expected to include foreign government participation. Private industry is expected to take the lead and assume principal responsibility for planning and total responsibility for financing and constructing the large scale prototype breeder.

An agreement between the Department of Energy and the Electric Power Research Institute (EPRI) to cooperate on the large scale prototype breeder effort was executed in FY 1982. EPRI has established a Consolidated Management Office (CoMO) to execute its responsibilities under the terms of the DOE-EPRI agreement. CoMO staff include representatives of the utility industry, reactor manufacturers and architect engineers. The private sector is contributing $10 million to this effort over the next two years; DOE has budgeted $15 million for FY 1983 and is requesting $15 million in FY 1984.

FY 1983 CoMO efforts are directed at: 1) establishing specifications for the large breeder that reflect requirements of the utility industry and design commonality, where possible, with foreign participants; 2) incorporating appropriate design changes into the previously established large plant advanced conceptual design to provide inherent safety, competitive economics, and low technical risks; 3) advancement of design with emphasis on capital cost reduction; 4) establishment of plant schedule and cost estimates; 5) continued evaluation of potential sites; and 6) initiation of environmental and safety documentation.

CoMO efforts during FY 1984 will be directed at finalizing all aspects of planning for the large scale prototype breeder. This includes definition of plant requirements and criteria; a schedule; a cost estimate; an evaluation of sites; research and development requirements; and financial, institutional and management arrangements. A safety analysis report, an environmental report, and a financial plan will also be prepared.

Liquid Metal Fast Breeder Reactor Base Technology Program

This program provides the technology base to enable the plant projects to proceed in a cost-effective manner, so the private sector can proceed with industrialization and deployment of the LMFBR.

The mission of the LMFBR base program is to develop the requisite technology to the point where the private sector is able to support construction and operation of safe, reliable liquid metal fast breeder reactor plants for supplying electricity to the grid.

The past year was a significant one for the base technology program in that many previous promises were realized. For example, the Fast Flux Test Facility (FFTF) ran for over 50 days of sustained full power operation, a U.S. LMBFR record. In addition, the FFTF was selected as one of 10 outstanding achievements of 1982 by the National Society of Professional Engineers. Another significant event was the start of performance testing of the Clinch River steam generator and main cooling pump at the Energy Technology Engineering Center (ETEC). Planned activities during FY 1983 include completion of the fuel storage and maintenance facilities at the FFTF site, initiation of water testing for the large developmental pump, and shipment of the Babcock and Wilcox helical coil steam generator for testing. Final concrete pour for the Fuels and Materials Examination Facility will be completed in FY 1983.

A more complete description of activities are highlighted in the section that follows.

Engineering Systems and Components

The Engineering Systems and Components program objective is to advance the state of knowledge and component technology development to the point where future economic and technical risks of designing, building, and operating safe, reliable, and economic breeder reactor components are acceptable and can be undertaken by the private sector.

The base program is not responsible for building large components for a project; rather, R&D is performed on new concepts that will form the technology base for the ultimate industrial decision. The program is carried out through generation of new concepts, identification and resolution of critical technical problems inherent in such designs, computer code prediction of design performance, conduct of R&D to verify behavior predictions of chosen materials in new configurations and environments, and testing of integrated concepts as models or test units to verify successful performance prediction and problem resolution.

R&D underway to support component technology development includes flow induced vibration analysis (including small scale Intermediate Heat Exchanger [IHX] flow tests, flow distribution testing and analysis, mixing and stratification testing and analysis), subcomponent development and testing, fabrication process development, inspection development, maintenance equipment, and procedure development. The Agency utilizes its unique facilities, including the Energy Technology Engineering Center (ETEC), for much of this testing, as well as industrial facilities where they exist.

To reduce technological risks and economic costs associated with components to a level acceptable for further private sector development, significant advances must be made in component reliability. There are two reasons for this. First, experience with breeder reactor powerplants in this country and abroad (Fermi, PFR, Phenix, BN-350, BN-600) has shown that plant component failures have been a major source of plant unavailability. Reliability problems are a cause not only of major economic impact, but also of potential impact on overall plant safety. The first aspect of assuring plant safety is to demonstrate reactor system reliability in preventing the occurrence of accident events that could ultimately lead to plant safety problems. The component technology development activities, including steam generator component and leak protection system development, support this reliability requirement.

Second, new component concepts must be developed since the requirements for commercial plants are different and, in some cases, much more stringent than those for demonstration plants, like CRBRP. For example, since the primary pump suction requirements for future plants are much higher than for CRBRP, development of a new concept such as a two-stage pump is required. This is an area of major program focus.

Likewise, components having major cost reduction potential must be developed and proof tested. Program focus centers on primary system inducer pumps, intermediate system pumps, instrumentation development, plus critical reviews of requirements imposed on components.

FY 1983 major accomplishments include:

o Complete the large leak sodium-water reaction testing series. The testing, which uses a prototypical CRBRP steam generator tube bundle, verifies analytical predictions of sodium-water reaction effects and confirms the need for reliable fast response leak protection systems.

o Complete water testing of a 1/3 scale model pump that duplicates the hydraulic characteristics of the 85,000 GPM intermediate system, sodium pump test article. Successful completion demonstrates acceptable hydraulic performance characteristics.

o Complete assembly of the helical tube bundle of the single wall tube, 70 MWt model steam generator. This accomplishment is a major milestone in demonstrating that a successful helical coil steam generator can be designed, fabricated, and operated for large LMFBR plant conditions.

- Complete the seven-tube model steam generator test program in October 1982. This test program, conducted at Westinghouse expense, demonstrates acceptable thermal and hydraulic characteristics for the Westinghouse double-wall tube steam generator design.
- Start assembly of the 85,000 GPM, two stage, primary system sodium pump test article and water test in preparation for sodium testing beginning in 1985 at the Energy Technology Engineering Center. This accomplishment is a major milestone in demonstrating that a successful primary system pump can be designed, fabricated, and operated for large LMFBR plants.

The FY 1984 activities include critical research and development efforts on steam generators and pumps. Planned accomplishments for FY 1984 are:

- Continue preparations for sodium testing of the helical coil model steam generator and the primary system two stage pump test article.
- Initiate tube installation in the 70 MWt double-wall tube steam generator.
- Complete design and continue fabrication of the intermediate system pump sodium test article.
- Continue primary system inducer pump design to secure weight and cost savings.
- Continue primary system inducer pump design to secure weight and cost savings.
- Complete demonstration of leak protection system on prototype steam generator.

Fuels and Core Design

The goals and objectives of the fuels program are: to prove a breeder fuel; to extend core life to burnup levels needed for commercial performance; to develop and prove the companion fuel blanket and absorber core component systems, to demonstrate LMFBR core systems that are licensable, to support CRBRP core requirements to extend core components' lifetime (to 3 years); to develop, establish and demonstrate an integrated fuel supply for FFTF and CRBRP; and to transfer developed technology to industry.

FY 1983 accomplishments include:

- o Successfully test FFTF mixed oxide fuel against all of its initial performance goals. The strategy is to prove that we have a sound LMFBR fuel and a sound blanket and absorber core system and to extend core life to burnup levels needed for economic performance.
- o Develop a system for detecting, locating, and identifying cladding leaks in fuel pins. System identified an experimental fuel pin as a "leaker" when the cover gas contained less than 2 parts per billion of fission and tag gases.
- o Improve lifetime of absorber assemblies (from one to two years). Additional data have shown that three-year lifetimes are attainable, consistent with the lifetime goal for economically competitive cores.
- o Evaluate results from an FFTF test assembly, specifically designed to determine the fuel pin power (Kw/ft) required to initiate melting in fresh fuel. Resulting data improve the accuracy of performance prediction codes.
- o Successfully compare predicted and measured FFTF core temperatures.
- o Culminate technical exchange agreements with foreign countries. About $17 million of foreign funds will be provided for cooperative programs on fuel performance.
- o Insert the Materials Open Test Assembly (MOTA) in the FFTF. The MOTA can monitor, maintain, and vary specimen temperatures.

- Complete conceptual design and continued development of the Secure Automated Fuel Fabrication Line (SAF) to produce LMFBR fuel using automated and remotely operated equipment and processes. This hands-off fabrication system eliminates personnel access to materials, essentially eliminates personnel exposure, and incorporates quality control, safeguards and security provisions to assure high product quality and protection against diversion.

Planned FY 1984 accomplishments include:

- Qualify, confirm performance, and establish lifetime limits of the FFTF fuel and absorber systems.
- Conduct fuel, blanket, absorber, and cladding/duct alloy program to assure safe, reliable, and predictable long-life performance.
- Continue efforts to support CRBRP fuel, absorber, blanket, and design code requirements.
- Complete SAF line final design.
- Continue optimizing current needs for destructive and nondestructive examination of fuels, blankets, absorbers, and materials to insure cost effective operation of national hot-cell facilities.
- Continue Run-Beyond-Cladding Breach (RBCB) and Transient Overpower Tests on oxide fuels as part of joint U.S./Japanese program in EBR-II.

Materials and Structures

As a vital part of the LMFBR program, efforts within the Materials and Structures area are directed at the resolution of problems typically experienced during plant design, construction, licensing, and operation; performing research and development as identified by plant projects; and establishing and documenting the technology base required for LMFBR industrialization.

The Materials and Structures activity addresses programmatic needs by:

- Providing technology to assure that LMFBR components and systems are free from structural failures during their design lifetime.

- Developing materials, design methods and criteria, materials property data, and procedures that will assure economic and safe components and systems while providing designers with sufficient flexibility in component and systems design to facilitate optimization.

The overall strategy includes (1) developing and providing timely design tools and guidance to design teams, (2) performing necessary R&D in support of the ultimate design choices, (3) maximizing the use of information derived from previous generic and specific (e.g., FFTF, CRBRP) research and development, and (4) maximizing the use of information derived from foreign exchange agreements. While early program emphasis was on structural integrity to assure reliability and safety, increasing emphasis is being given to economic considerations and the ability of the private sector to proceed with the next LMFBR plant.

FY 1983 accomplishments include:

- Complete generation of mechanical properties data and issued equations that will allow more accurate structural analysis for advanced steam generators and design support for CRBRP steam generators.

- Complete measurement of fracture mechanics properties that will be utilized in the design of CRBRP reactor vessel internal support structure, thereby allowing the design to continue on schedule with confidence.

- Complete determination of physical properties for stainless steel castings that will aid in lowering costs of components.

- Complete a series of important steps with the American Society of Mechanical Engineers to allow the use of 9 Cr-1 Mo steel that will prepare the breeder industry for major advancements in the utilization of this high strength, low cost material.

- Complete seismic testing of a small piping model, thereby verifying the conservatism of current design methods leading to reduced hardware costs, and providing designers and NRC with more accurate data and techniques for seismic design and evaluation.

Planned accomplishments in FY 1984 include:

- Complete development of methods for inservice inspection of double-wall tube steam generators.

- Complete development of seismic analysis methods for LMFBR core assemblies.

- Publish design methodology for elevated-temperature piping expansion joints.

- Develop design methods and criteria for elevated-temperature welds.

Physics

The purpose of the physics program is to prove and reduce to practice LMFBR data bases and analytical design capabilities needed for FFTF operation, CRBRP licensing, plant startup and efficient performance, and confident design of a commercial plant. Key elements are acquisition, testing and implementation of detailed nuclear data and analytical design capabilities, measurements and analyses of physics parameters in critical assemblies, and analyses of advanced core and shield design options. Priority efforts provide direct support of specific CRBRP licensing matters and studies of FFTF operating data, and contribute capabilities needed by industry for predicting the design and safety of future LMFBR plants.

FY 1983 accomplishments include:

- Conduct experiments in Zero Power Plutonium Reactor, the largest fast reactor critical facility in the world, to measure reactivity worth of sodium voids. Tests will aid the resolution of this problem in CRBRP before the Nuclear Regulatory Commission.

- Conduct measurements in Zero Power Plutonium Reactor that identify the reason for a longstanding difference between measured and calculated values of reactivity changes caused by use of difference materials in breeder reactor designs. This will improve accuracy in calculations and result in lower cost cores.

- Provide industrial designers with an advanced design code that will produce major improvements in accuracy and resultant reductions in the cost of design calculations.

Major program accomplishments expected in FY 1984 are:

- Perform engineering benchmark criticals for 700 MWe-scale heterogeneous cores in Zero Power Plutonium Reactor. These will address aspects of design for which no confirmatory data exist.

- Perform analyses of the most crucial shielding issues for advanced LMFBRs.
- Validate advanced transport and three dimensional design methods and data files for accurate and economical analyses of large critical experiments, reactor operating data, and industrial design of advanced LMFBRs.
- Perform measurements of nuclear data required for later completion of Evaluated Nuclear Data File-VI.
- Perform analyses of early Fast Flux Test Facility operations and fuel burnup contributing to evaluation of neutronic methods and data bases for CRBRP and future plants.

Safety

The Safety program is directed to the public safety considerations associated with LMFBR's. The mission of the program is to: provide an adequate data base for licensability and assessment of risk to the public, and influence safety design features of LMFBR's. The efforts lie in two main areas: 1) prevention of accidents and 2) mitigation of accident consequences.

The safety program supports the licensability and industrialization of the LMFBR by demonstrating the public safety of large breeder reactors. It influences LMFBR design by identifying and exploiting inherent plant characteristics to enhance safety, reduce complexity, and reduce capital cost. Action will be taken in parallel with these activities to develop plant safety design criteria and a licensing approach that will reflect the renewed emphasis on inherency, improved safety, and reduced cost.

The program addresses important technical issues in both accident prevention and mitigation of accident consequences as follows:

1. Reliability of plant systems and safety features--through accumulation and analysis of performance data from operating plants.
2. Safety margins under degraded plant conditions--through verification of sodium natural circulation cooling under extreme transients.
3. Accommodation of core disruptive accidents--through demonstration of adequate containment of energetic accidents and heat-producing accident debris.
4. Plant siting and accident health effects--through demonstration of limited fuel aerosol releases to the environment.

FY 1983 accomplishments include:

- Install a newly developed man-machine interaction system in FFTF. This system will minimize operator workload and aid in scheduling maintenance and repairs for more than 50,000 operating plant components.
- Complete a series of eight in-reactor safety experiments in the Transient Reactor Test Facility. This was the first set of experiments conducted under the US/UK agreement to provide useful licensing data.
- Complete a series of out-of-pile experiments that demonstrated inherent capability of molten fuel to disperse away from the core during serious accidents, thereby shutting down the reactor.
- Complete a series of sodium concrete reaction experiments that allow DOE and NRC to resolve a controversial matter, resulting in elimination of a CRBRP licensing issue.

Major program accomplishments expected in FY 1984 are:

- o Complete three safety transient tests of breeder reactor fuel in TREAT.
- o Complete the first major decay heat removal test series in the Thermal-Hydraulic Out-of-Reactor Safety (THORS) Facility.
- o Complete Self-Actuated Shutdown System (SASS) component development and provide large plant project with recommendations on preferred configuration and integrated system testing.
- o Complete a water experiment that validates multidimensional computer codes for in-vessel decay heat removal in large plant designs.
- o Complete severe protected sodium natural circulation tests in EBR-II.

Test Facilities

The major objective of the test facilities effort is to provide an experience base for safety, components, and system operation. This experience provides a proven baseline for scaling up systems and components and provides a library of developed and verified sound operating and maintenance procedures to plant projects and the base technology program. The test facilities effort operates and maintains facilities and multiprogram sites at Hanford Engineering Development Laboratory, Energy Technology Engineering Center, and Argonne National Laboratory to meet LMFBR program test requirements and schedules established by the breeder technology research and development program.

FY 1983 accomplishments include:

- o Complete initial performance tests on the CRBRP plant prototype steam generator in the 70 megawatt Sodium Components Test Installation at Energy Technology Engineering Center. Results will be factored into fabrication release for CRBRP plant units. This first major use of Sodium Components Test Installation since upgrade from 35 to 70 megawatts thermal demonstrates operability of the world's largest LMFBR steam generator test facility.

- Complete planned performance test program on the CRBRP prototype primary sodium pump in the Sodium Pump Test Facility at Energy Technology Engineering Center. Confirm basic pump design and identify changes desirable for CRBRP plant units, and demonstrate operability of the world's largest LMFBR Sodium Pump Test Facility.

- Complete comprehensive series of large leak sodium-water reaction tests on full diameter model of CRBRP steam generator in the Large Leak Test Rig at Energy Technology Engineering Center. Provide confirmation to predict and accommodate large leaks in the LMFBR steam generator systems. Confirm need for prompt leak detection and response techniques to avoid economic penalty.

- Complete first full cycle of the Fast Flux Test Facility operations. This operation established record for longest period of continuous full power operation (53 days) of any United States liquid metal fast breeder reactor to date. Initiate experimental irradiation testing to confirm breeder reactor reference and advanced fuel systems.

- Complete concrete emplacement in the Fuels and Materials Examination Facility at Hanford.

- At the Hot Fuel Examination Facility, continue handling and examinations of Fast Flux Test Facility, the Transient Reactor Test Facility including the United States/United Kingdom joint tests, and the Experimental Breeder Reactor II test fuel. Examination of first FFTF driver fuel experimental assembly demonstrates facility capability to support FFTF operations and experimental testing program.

- Achieve cumulative 19 year electricity production of over 2 billion kilowatt hours at EBR-II, and cumulative 19 year irradiation capability of over 200,000 megawatt-days thermal.

In FY 1984, the actions initiated in prior years to consolidate testing and demonstration activities will continue. Existing facilities will be used where they are adequate for R&D program needs and surplus facilities will be phased out. Initiatives will be pursued to further reduce operating costs of the various test facilities.

Water Cooled Breeder Program

The Water Cooled Breeder program's mission is to develop technology for significantly improving the efficiency of nuclear fuel resource utilization by water cooled nuclear reactors used for electrical power generation. The concept being evaluated is a self-sustaining breeder reactor, cooled and moderated with ordinary (light) water and fueled with uranium-233 and thorium.

Successful confirmation of breeding in the Shippingport light water breeder core will provide the basic technology that would make available for power production about 50 percent of the energy in the nation's thorium reserves, a source of energy many times greater than the known fossil fuel reserves. This concept is the only known approach using the proven technology of the light water reactor system for increasing fuel utilization efficiency significantly beyond the approximately 1 percent achievable with present types of light water thermal reactors.

The FY 1984 Water Cooled Breeder budget request is $35.5 million.

Defueling Activities

In October 1982, the Shippingport plant ceased routine operation with the Light Water Breeder core and end-of-life testing and reactor defueling began. The Shippingport defueling effort will take approximately 2 years, ending in FY 1984. The overall defueling activities will continue until completion of fuel shipments from the Expended Core Facility (ECF) to the Idaho Chemical Processing Plant in 1987.

Efforts associated with the defueling process in FY 1984 include: maintaining the Shippingport plant and providing instrumentation, control, and electrical power system operational support for the light water breeder core defueling; completing core defueling, head area disassembly, fuel removal, and equipment disposal; disassembling fuel modules for shipment; continuing ongoing training of personnel at the Expended Core Facility in Idaho to receive and handle the spent fuel; continuing preparation of procedures and installation of equipment; shipping the spent fuel and receiving the spent fuel modules at ECF; placing the shipping containers in the water pits, unloading the containers, and transferring the fuel to water pit storage receptacles.

Other defueling efforts will include: providing radiation analysis for component disposal and disposing of removed core components; shipping a spare fuel module and fuel rods to the Idaho Chemical Processing Plant for storage; and preparing the Shippingport plant for turnover to the DOE Office of Waste Management upon completion of the defueling and shipment of the spent fuel.

Assessment and disposal of components removed from the Shippingport reactor vessel prior to installing the light water breeder core will continue. This includes shipment of the lower core barrel from the previous core.

Core Evaluation

A detailed core evaluation at the Expended Core Facility is necessary to determine the condition of the core and establish the extent of breeding achieved. Core evaluation is expected to take 5 years.

During FY 1984, work conducted under the Core Evaluation subprogram will include: assessing end-of-life test data; publishing technical reports documenting the Shippingport Light Water

Breeder Reactor performance; preparing for examination and proof-of-breeding work; and conducting work necessary to provide fuel rods for destructive analysis. Destructive analysis work is funded under the DOE Fuel Cycle Program.

CONVERTER REACTOR SYSTEMS

The overall goals of the Converter Reactor Systems Program are threefold: 1) to improve the efficient and safe use of converter reactors through improvements in Light Water Reactor (LWR) technology, 2) to contribute to the resolution of the nuclear industry's regulatory, financial, and institutional problems, and 3) to fulfill the Federal Government's research and development commitment associated with General Public Utilities' cleanup of Three Mile Island (TMI). In FY 1984, this program will focus on the following activities: 1) the Loss of Fluid Test (LOFT) facility; 2) research and development and information retrieval on TMI; 3) in-house regulatory, financial, and institutional analyses of obstacles to a healthy nuclear-electric industry; 4) coordination of a national LWR safety program; and 5) completion of work on a single LWR fuel design for extended burnup.

The FY 1984 budget request for Converter Reactor Systems is $53.2 million, down from $78.8 million in FY 1983. The following table reflects the breakout of these funding levels.

	(B/A in Millions)	
	FY 1983	FY 1984
Light Water Reactor Systems	$ 10.0	$ 15.0
High Temperature Reactors	35.3	0.0
Three Mile Island Activities	29.0	37.0
Advanced Reactor Systems	4.2	0.0
Program Direction	0.3	1.2

Light Water Reactor Systems

Since FY 1976, the LWR program has been concerned with developing and demonstrating technical advances in the design, manufacture, and operation of LWRs in order to enhance their safe and efficient use as a source of base-load electrical energy. Today, the major problems confronting the nuclear reactor industry are no longer technical, but are institutional, financial, and regulatory in character and as such the FY 1984 Converter Reactor Program places more emphasis on these. The foremost priority in this regard is reform of the current, inefficient NRC licensing process. I will now briefly discuss each of the Converter Reactor Program activities.

Light Water Reactor Institutional and Safety Program

The proposed LWR safety R&D program has been reoriented to provide the technology base needed to support institutional improvements in the way nuclear technology is licensed and regulated. In particular, support for nuclear regulatory reform proposals and for satisfying the requirements of the Nuclear Safety Research, Development, and Demonstration Act of 1980 (Public Law 96-567 - to develop a technical basis to effect improvements in the ability of LWR industry to produce reliable, economic, and safe nuclear power) are provided for in the FY 1984 program plan.

Our objectives pertaining to regulatory reform fall into five major categories. First, approval of standard designs. This provision would authorize the Nuclear Regulatory Commission (NRC) to approve standard designs for entire plants or subsystems so that utilities have the option of choosing a plant of preapproved design in lieu of one-of-a-kind or customized plant design. The objective is not only a major improvement in both time and dollars required to review, certify, and build a plant to meet the NRC's safety criteria, which will translate into lower costs to consumers, but an enhanced degree of public health and safety due to greater familiarity with the plant during its construction and operation.

Second, advanced site approval. This provision authorizes the NRC to approve sites for prospective nuclear plants in advance of a utility's decision to apply for permission to construct such a plant. The objective is to provide for earlier and more effective public participation in the site selection process before significant funds are expended, thereby reducing unnecessary expenses and costly planning uncertainties.

Third, integrated licensing procedures. This provision permits utilities to apply to the NRC for a construction and operating license in one proceeding in lieu of the current process whereby a construction permit and an operating license are obtained at different stages of the process. The objectives are more meaningful participation for the public, a more systematic and comprehensive review by the NRC, and greater predictability and certainty for utility planners.

Fourth, centralized review of proposed design modifications. This provision requires the NRC to provide for centralized review and approval of all backfitting proposals made by the NRC's staff. The objective is better prioritization and more logical sequencing of modifications that have been judged to offer significant safety improvement, thereby minimizing wasteful duplication of effort. In addition, criteria would be established which would require a design modification to result in a significant improvement in public health and safety when considered over the life of the plant before it could be incorporated. More attention would be paid to a proper balancing of costs to the consumer of plant backfits, and the potential improvements in their health and safety.

Fifth, improvement in the hearing process. This provision allows legislative hearings for most issues, thereby reserving adjudicatory hearings for contested issues of material fact. It also assures that issues already settled in other proceedings do not have to be reviewed again unless additional material facts are introduced. The objectives are to focus more time and resources of the NRC on substantive public health and safety issues, while at the same time permitting a more effective licensing process.

To satisfy the legislated requirements of the Nuclear Safety Research, Development and Demonstration Act, the Department will coordinate the development and implementation of a DOE/NRC/industry cooperative program to establish the priorities of institutional and technological safety issues and to determine how best to resolve these issues. The first step will be the development of a systematic and integrated approach to LWR safety.

The program is divided into two phases--a program definition phase and a program implementation phase. Program needs and priorities are being defined by utilizing working groups composed of representatives from DOE, NRC, industry, and national laboratories. DOE has convened ten of these working groups. Additionally, the three specific studies required by Public Law 96-567 (A Comprehensive Program Management Plan, The Need and Feasibility of a National Reactor Engineering Simulator, and the Sufficiency of U.S. Efforts to Provide Specially Trained Operators for Nuclear Plants) were submitted to the Congress in FY 1982.

Anticipated accomplishments in FY 1983 include:

- Continuation of work with utilities to improve plant operators response to accident conditions and ability to restore a plant to a normal operating condition.
- Completion by the Institute for Nuclear Power Operations (INPO) of job and task analyses for powerplant operators so that improved training programs can be developed for coping with accidents.
- Continuation of support for and coordination of working groups developing the national safety R&D program as required by P.L. 96-567.

Expected accomplishments in FY 1984 include:

- Support for the enactment and implementation of licensing and regulatory reform legislation.

- Development of specific solutions to the institutional and financial problems of nuclear electric utilities.
- Continued coordination of the national safety R&D program consistent with P.L. 96-567.

Since these activities can be accomplished with internal departmental resources, we are only requesting funding in FY 1984 for personnel positions.

Loss of Fluid Test Program

The LOFT program is an internationally funded activity. In FY 1984, this program will adapt the unique capabilities of the LOFT facility (which otherwise would be lost as current related NRC R&D programs are completed) to provide data necessary to reduce uncertainties in primary and containment system responses to severe transients and accidents. Nine tests are planned over a 3-year period with a final severe test to simulate actual fission product releases from a fuel melting accident. The program will be directed by a consortium of the participants and will rely heavily on input from the nuclear industry. The participation of industry is expected to result in a greater focus on economic as well as safety related improvements. It is estimated that program costs from FY 1983 through FY 1986 will be $93.5 million. Of this amount, $25.0 million is FY 1983 NRC LOFT program funds, $15.0 million is FY 1983 NRC funds related to LOFT decontamination and decommissioning that the NRC has committed but Congress has not yet appropriated, $30.0 million is new DOE program funds, and $23.5 million will be contributed by foreign countries.

LWR Extended Burnup

The Extended Burnup Program through FY 1983 has consisted of: first, major projects conducted by selected electric utility/LWR fuel vendor teams to evaluate the extended burnup performance of specific fuel designs, and secondly, several smaller projects to obtain basic data on extended burnup phenomena needed for design and licensing.

The planned accomplishments for the Extended Burnup program in FY 1983 include: 1) the continuation of efforts to obtain generic design and licensing data and other necessary supporting technology and 2) continuation by utility/vendor teams of major R&D projects on extended burnup in LWRs.

In FY 1984, the basic data effort will be continued using funding still available from prior years' appropriations. Some major cost-shared contracts to develop other fuel designs will be cancelled. These efforts will complete Government support of this subprogram. Private sector organizations such as the fuel vendors, utilities, and the Electric Power Research Institute will--if interest exists--conduct the balance of the previously planned program activities without Government assistance.

Light Water Reactor Radiation Dose Reduction Program

No funds are being requested for this program in FY 1984. The phaseout of ongoing projects is being carried out using funds provided in prior years.

High Temperature Reactor

Due to its advanced developmental status, a commercial plant in operation, and the lack of a compelling reason for a new converter reactor concept at a time when there is no market for proven LWRs, no funding for the High Temperature Gas-Cooled Reactor Program is proposed in FY 1984. The focus of the FY 1983 program will be to continue ongoing technology and conceptual design tasks for the steam cycle/cogeneration configuration of the Lead Plant design.

Application and related design and technology studies of advanced and higher temperature modular reactor systems will also be completed in FY 1983 and data will be retained for potential applications to numerous industries that are presently dependent on fossil energy sources. The program will come to an orderly closeout at the end of FY 1983.

Three Mile Island Activities

This program is discussed under Commercial Waste Management.

NUCLEAR FUEL CYCLE

The Nuclear Fuel Cycle program provides for development and demonstration of advanced technology for reprocessing of irradiated fuels from nuclear power reactors. The program will address the stringent requirements associated with reprocessing Fast Breeder Reactor (FBR) fuels, including the higher thermal and radiation burdens, higher fissile content, sodium contamination, and heavier fuel assembly structures. Advanced development for FBR fuel reprocessing will also be available for use by future LWR fuel reprocessors. The technical program will focus on development and demonstration of reprocessing technology that will provide for reduced radiation exposure to workers, increased environmental protection, increased reliability, enhanced safeguards, and reduced costs.

In FY 1983, installation and testing of equipment in the Remote Operations and Maintenance Demonstration (ROMD) section of the Integrated Equipment Test (IET) facility--the "cold" prototype equipment test facility at Oak Ridge--will continue to evaluate performance and the ability of the equipment to be maintained remotely. Testing will include the continuous rotary dissolver, centrifugal contactors and manipulators needed for remote operations and maintenance. Also, the Integrated Process Demonstration (IPD) section of IET will be put into service. Support efforts will also proceed on instrumentation and control, analytical chemistry, environmental protection, radiation protection, safety and safeguards.

In FY 1984, development of critical components and systems that are to be remotely operable and maintainable will continue. The fuel disassembly and shear machine will be installed and undergo tests in ROMD. Testing of the industrial standard manipulator will continue and testing of an advanced design will be initiated. Conceptual design studies initiated in FY 82 will be continued, and engineering support in IET started, to examine alternative means of developing and demonstrating in a prototypic hot operational environment the necessary breeder reprocessing technology.

Efforts in FY 1984 will also include providing supporting analysis and evaluation for the LWBR proof-of-breeding demonstration, implementing a program to assure adequate means exist for handling and shipping irradiated breeder fuel, and managing the program (funded by ACDA in FY 84 and beyond) to develop alternate low-enriched fuel system for use in test and research reactors currently operating on highly-enriched uranium fuel.

In addition to R&D efforts, the Department is continuing to analyze the institutional impediments to commercial reprocessing of Light Water Reactor fuels, consistent with the directives in the President's nuclear policy statement of October 8, 1981. We have identified a number of major obstacles and will continue to work towards creating an environment in which private industry can again undertake efforts in commercial reprocessing with acceptable business and technical risks.

ADVANCED NUCLEAR SYSTEMS

The Advanced Nuclear Systems Program supports civilian and military space applications through the development of a range of nuclear power system options. Nuclear power sources have provided the electrical energy for the NASA Pioneer, Viking, and Voyager missions, as well as earlier lunar and earth orbital missions. Since 1961, the United States has launched 22 NASA and military space systems having all or part of their power requirements supplied by nuclear power sources.

The Advanced Nuclear Systems budget request for FY 1984 is $34,105,000, a $4,838,000 decrease from the FY 1983 appropriation. Distribution of the funds for Advanced Nuclear Systems is as follows:

Advanced Nuclear Systems	FY 1983	FY 1984
	(in thousands)	
Flight Systems Development	$17,170	$14,635
Flight Systems Support	20,792	17,100
Special Applications	0	1,000
Program Direction	981	1,370
Total	$38,943	$34,105

This activity is a direct application of the nuclear expertise within the Department of Energy to support approved United States missions of the National Aeronautics and Space Administration, the Department of Defense, and other Federal users.

In accomplishing the responsibilities and in keeping with related statutory requirements, the Department and its predecessor agencies have, over the years, developed a unique complex of laboratories and personnel dedicated to nuclear space power research and development, with a strong emphasis on working within established safety and environmental guidelines. These laboratories have degrees of expertise in producing special nuclear material, forming the isotope material into the desired chemical and physical state, analyzing the materials, and testing the fueled units. Because of the potential safety concerns associated with the use of special nuclear materials, the Department, its laboratories, and contractors have developed extensive expertise, equipment, and facilities for the safe handling of this material. It is because of these unique nuclear capabilities, plus the attendant health and safety responsibilities that the Department--as did the predecessor agencies--has the overall lead responsibility within the Federal government for the development of nuclear power sources for use in space.

In fiscal year 1984, the major undertaking will continue to be the development of the nuclear isotope power generators for use on the NASA Galileo spacecraft and on the NASA/European Space

Agency (ESA) International Solar Polar spacecraft, both planned for launch in 1986.

Another major activity is the continuation of the space nuclear reactor power development program in cooperation with NASA and DOD. The objective of this program is to develop space nuclear reactor power sources capable of producing 100 kilowatts or more of electrical power. NASA missions involving nuclear electric propulsion, space stations, lunar operations, and planetary exploration and DOD applications involving communications, surveillance, electronic jammers, and space command defensive weapons will require power levels in this range.

Technology activities are planned to continue towards development of an Advanced modular isotope thermoelectric generator (MITG). This project will enter into the ground demonstration phase. It is envisioned that this generator, with its significant improvements in modularity and high specific power to weight ratio, will be the cornerstone to support the NASA planetary and DOD missions of the future.

Flight Systems Development

This subprogram element includes the design, development, fabrication, and assembly of the isotope space power converter subsystems for the NASA Galileo and NASA/ESA International Solar Polar spacecraft. Several flight converters are planned to be completed and shipped from General Electric, Valley Forge, Pennsylvania, to the Mound Plant, Miamisburg, Ohio. They will be supported by this subprogram element throughout the flight acceptance tests at the Mound Plant. The electrically heated engineering converter will be operated on a long-term endurance test, and technical support will be provided by General Electric to the Mound Plant on the endurance test of the isotope fueled qualification generator. The Final Safety Analysis Report for Galileo and the Updated Safety Analyses Report for ISPM are planned to be published. The Department is currently renegotiating the Interagency Agreements with NASA to include reimbursable work for both the qualification and flight spare units. NASA currently plans to reimburse the Department for all flight units delivered for the Galileo and ISPM mission.

Under the Space Reactor Development Program, which is funded within this subprogram, it is planned to continue component development and reactor concept design definition efforts. Several component subassemblies of the reactor core and heat pipes will undergo testing and analyses along with appropriate safety analyses and overall reactor core design efforts. Several thermal power levels will be examined to determine what type reactor subsystem warrants further development.

In FY 1983 the following efforts were accomplished:

Heat Pipe Reactor (HPR)

- Reactor design reviewed and refined
- Critical experiment performed
- Preliminary mechanical and thermal analyses performed
- Prototype core heat pipe tested at design conditions
- Materials compatibility tests in progress
- First in-pile experiment designed and approved for insertion into EBR-II in 1983
- Initial safety program plan completed
- Water immersion criticality studies performed

Alternative Concepts

Several study contracts were initiated to identify and evaluate alternative concepts. Final design selection will depend on results of ongoing and planned studies under the Space Reactor Development Program, and on Statements of Operational Needs of user agencies.

In FY 1984 the following activities are planned:

HPR

- Continue reactor design activities
- Continue development of material data base
- Continue development of critical component technology

Alternative Concepts

- Continue to evaluate alternative concepts

Flight Systems Support

This funding element supports fuel form production, encapsulation, heat source component manufacturing and assembly, environmental testing of the fueled flight units, and the overall independent safety and safety testing activities.

In fiscal year 1984, the following activities are planned:

- Conduct heat source assembly, fueling and flight acceptance testing of a Galileo and an ISPM radioisotope thermoelectric generator (Mound Plant).
- Conduct independent safety analyses and safety testing (Los Alamos National Laboratory).
- Conduct independent quality assurance and quality control efforts plus independent technical support activities.

Special Applications

This subprogram covers design and integration studies, development tests on advanced radioisotope thermoelectric generator (RTG) components aimed at extending power system lifetimes and minimizing personnel exposure operations, and analyses of compact nuclear reactor powerplants at the request of the Department of Defense (DOD). These efforts are being conducted for application at various DOD facilities. In addition, general nuclear related studies, assessments, and nuclear training programs are also supported.

In FY 1984, the following activities are planned:

- Support system application studies of terrestrial RTG users by conducting power system trade-offs, integration studies, and performance analyses.
- Evaluate the potential of existing space system RTG technology and designs for applicability to terrestrial uses.
- Develop RTG design concepts for terrestrial applications, considering modularity for varius power levels and the potential environments.
- Evaluate modifications or changes to existing thermoelectric material and converter designs to increase reliability, lifetime, voltage requirements for particular applications, and efficiency.

STATEMENT OF ROBERT L. MORGAN, PROJECT DIRECTOR, NUCLEAR WASTE POLICY ACT PROJECT OFFICE

I am pleased to appear before you today to discuss the Department of Energy's (DOE's) FY 1984 commercial nuclear waste management and spent fuel storage budgets and these programs. These programs are provided for in the Nuclear Waste Policy Act of 1982 which the President signed into law on January 7, 1983. I am very grateful to this Committee for its help in passing the Act. I also ask for your continued support and cooperation in helping implement the major national objectives of this program.

Secretary Hodel is determined that we mobilize the necessary resources to assure that a mission-oriented coordinated effort is conducted to meet the elaborate set of near-term requirements and actions that are required to be accomplished within the first 180 days by this Act. However, the Secretary and I are also equally committed to following a course that addresses all of the institutional issues and concerns that are of critical importance to the success and ultimate public acceptance of this program. Our concern for adhering to the institutional processes, for instance, consultation and concurrence with State and local Governments, will receive the same consideration as our concern for adhering to the program's technical requirements.

We have recently established a Nuclear Waste Policy Act Project Office. As Director of this Project Office, I shall be responsible for DOE's initial activities to implement the Act. This Project Office will be operational until the Office of Civilian Radioactive Waste Management, established by Section 304 of the Act, is activated. The Project Office will be structured as depicted in Attachment 1. It should be clearly understood that this Project Office is not a permanent organizational structure; it was solely established to implement the provisions of this Act that require action in the near term.

The Project Office is responsible for three major budget activities. The funding for these activities is summarized below.

Nuclear Waste Policy Act Project Office
Budget Summary
($ in Millions)

Program	FY 1982 Actual	FY 1983 Contin. Resol.	FY 1984 Congr. Request
Nuclear Waste Fund	-	217.3	306.7
Commercial Waste Management[a/]	190.3	24.0	6.3
Spent Fuel Technology[a/]	6.8	6.4	5.0
Project Office Total	$197.1	$247.7	$318.0

[a/] Denotes portions managed by the project office.

The Act requires major efforts in two primary areas: disposal and storage of spent fuel and high-level waste. Efforts in the former area are to be financed by fees collected from utilities and placed into a Nuclear Waste Fund for disposal services. Under the Continuing Resolution, the FY 1983 appropriation for activities covered by this fund is $217.3 million. In FY 1984, we are requesting an appropriation of $306.7 million. Current waste management activities, subseabed R&D, and supporting studies, are not eligible for coverage under the Waste Fund and will remain as an element of our annual commercial waste request. In FY 1984, we are requesting $6.3 million for these activities. The Nuclear Waste Fund has become operational. We are in the process of transferring all unobligated appropriations as of January 7, 1983, into the Fund. Initial revenues of $98 million are projected to partially offset this appropriation in FY 1983. During FY 84 and out years, revenue flow will approximate $40 million monthly, based on a 1 mill KWH charge; equalling a half billion dollars on an annual basis. In addition, there presently is existing spent fuel with anticipated revenue amounting to approximately $2 billion dollars in inventory at reactor sites.

The Act provides for Federal storage of up to 1900 metric tons of spent fuel for those utilities that the Nuclear Regulatory Commission (NRC) determines cannot reasonably provide sufficient additional on-site storage. This Federal storage is to be financed through utility user fees that are placed into an Interim Storage Fund. The Act also provides for cooperative research, development, and demonstration activities at utility sites and Federal sites. These activities are to be jointly funded by the utilities and the Federal Government. Lastly, there are generic research and development (R&D) activities in the spent fuel area that are funded from general appropriations. The FY 1983 appropriation under the Continuing Resolution was $6.4 million for the Spent Fuel Storage Program, and the FY 1984 request is $5.0 million. The storage fund may become operational in FY 1983, however, we currently do not forsee a need to transfer any FY 1983 appropriations into the fund, and consequently, the exact date for execution of the fund may await a signal from a utility that it needs storage services and wishes to sign a contract with DOE for interim storage.

With your permission, Mr. Chairman, I shall now highlight the key provisions of the Act and then describe how these provisions are being implemented.

THE NUCLEAR WASTE POLICY ACT OF 1982

Under the provisions of this Act mandated milestones have been established in the areas of fund management, geologic repository, monitored retrievable storage, and spent fuel storage. Specifically, the Act established the following activities in each of these areas:

Fund Management

The Secretary is authorized to enter into contracts with owners or generators of spent nuclear fuel or high level waste for disposal in return for the payment of fees. To implement this activity, the Department on February 4, 1983, published in the Federal Register for public comment a proposed contract which outlines the terms and conditions for making available nuclear waste disposal services and associated financial procedures. The proposed contract will cover transfer of title to the Department, transportation, and disposal of civilian nuclear waste. The contracting party will pay a fee to the Department for such services. Revenues derived from such services will be deposited into the Nuclear Waste Fund. Written comments on the contract and financial procedures must be submitted by interested parties by March 7, 1983. Also, a public hearing will be held on March 3, 1983. Comments received will be assessed and possibly incorporated into the contract for publication as a final rule on April 7, 1983. Owners or generators of spent fuel and/or high level waste will then have until June 30, 1983, to execute the contract with the Department. A standardized contract applicable to all parties is envisioned, although deviations will be permitted for unique circumstances. This timetable satisfies the statutory requirements contained in the legislation.

In addition to developing a contract and financial procedures the Department has developed fee options for existing spent fuel. The selected option will be announced by April 7, 1983, and incorporated into the final contract.

Geologic Repository

o A schedule and associated processes for siting, licensing, and constructing geologic repositories for the disposal of nuclear waste is as follows:

  - General guidelines for the recommendation of potential repository sites will be issued by July 1983.
  - Five sites must be nominated for detailed site characterization.
  - At least three sites for detailed characterization must be recommended to the President no later than January 1985.
  - The President will recommend to Congress by March 1987 the site to be designated as the first repository.
  - NRC must act on the license application no later than August 1990. (Assuming DOE License submittal by August 1987)
  - The President will submit a recommendation for second repository site to Congress by March 1990.
  - In return for payment of fees, DOE will dispose of nuclear waste beginning no later than January 1998.

o Procedures for participation by States and Indian Tribes.

  - States with potentially acceptable sites for the first repository are to be notified by April 1983.
  - At the request of a notified State, procedures for consultation and cooperation must be specified in written agreements.

  - Public hearings will be required in States in the vicinity of potential repository sites.
  - A State may submit to Congress a notice disapproving of the site finally designated as the repository. Disapproval can only be overridden by a joint resolution.
  - Grants and impact aid will be made available to affected States and affected Indian tribes.

- A program of research and development, including an underground Test and Evaluation Facility (TEF).
- Provisions for a Monitored Retrievable Storage (MRS) Program.
  - DOE will submit a report to Congress describing the research and development activities necessary to develop the MRS proposal by July 7, 1983.
  - DOE will complete a detailed study of the need for and feasibility of the construction of one or more MRS facilities and submit a proposal for the construction of the first such facility with supporting plans and analyses by June 1, 1985.
- A Research and Development Program for spent nuclear fuel storage
  - By January 7, 1984, DOE will select one to three reactor sites for a licensed demonstration with utilities of dry storage technologies.
  - DOE plans to conduct a demonstration of dry storage technologies, using up to 300 metric tons of spent fuel, at several sites as required to support the licensed demonstration.
  - DOE will conduct generic R&D to support Federal and private storage initiatives.
- A Federal Interim Storage Program
  - DOE will conduct generic R&D to support Federal and private storage initiatives.

- DOE will provide not more than 1900 metric tons of storage capacity for civilian reactors that cannot reasonably provide sufficient at-reactor capacity.
- DOE will submit a fee study for Federal Interim Storage by July 7, 1983.
- NRC determines eligibility for Federal Interim Storage.

o A program will be undertaken to cooperate with and provide technical assistance to foreign nonnuclear weapon states in the field of spent fuel storage and disposal.

Disposal Activities

The Act establishes a step-by-step process by which the President, the Congress, the States, affected Indian Tribes, the U.S. Department of Energy and other Federal agencies can work together in the siting, construction, and operation of a high-level nuclear waste repository. One of our priorities is to strengthen consultation and cooperation between DOE and affected States and affected Indian Tribes. The Act provides a firm basis for this cooperation. In this regard, we intend to ensure that a solid technical program is developed and that State, and local, and tribal officials are afforded the greatest possible opportunity to provide input so that together we can move forward toward meeting our national goal of solving the issue of nuclear waste disposal by 1998.

DOE is required by Section 116(a) of the Act to identify States having potencially acceptable sites for a waste repository. A potentially acceptable site is defined by the Act as "any site at which, after geologic studies and field mapping but before detailed geologic data gathering, the Department undertakes preliminary drilling and geophysical testing for the definition of site location." Based on the information acquired thus far, we believe that the states of Louisiana, Texas, Utah, Mississippi, Nevada, and Washington each contains a potentially acceptable site for a repository. Accordingly on February 2, 1983, Secretary Hodel sent letters to the Governors and legislative leaders of those states formally notifying them of these findings.

As an early step, the Act requires that the DOE issue Guidelines for the recommendation of sites for a repository within 180 days of enactment. The proposed Guidelines were published in the Federal Register for public review and comment on February 7, 1983. These Guidelines will be used to identify and nominate sites for characterization and eventually to determine the suitability of a site for development as a repository. Through consultation with the interested Governors, the Council on Environmental Quality, the Environmental Protection Agency, the U.S. Geological Survey, and with the concurrence of the U.S. Nuclear Regulatory Commission, we plan to finalize these guidelines no later than July 7, 1983, as required by the Act. To facilitate public involvement, we shall hold public hearings during the Guidelines comment period. These hearings will be held in early March in Seattle, Chicago, New Orleans, Washington, D.C., and Salt Lake City.

The next step under the Act is DOE's initial nomination of five locations for site characterization, based on a consideration of the Guidelines and the environmental assessments (EA's) to be prepared for each of the five nominated sites, followed by a recommendation of three candidate sites to the President for his approval. DOE intends to complete these actions in the summer of 1983 in order to permit the conduct of a sufficiently thorough site characterization program at each site to support the Presidential recommendation of a site for the first repository by March 31, 1987, as required by the Act. The Act requires that for each site under consideration, DOE conduct public hearings to solicit recommendations on issues to be addressed in the environmental assessment and in any site characterization plan to be used if the site is approved by the President. The specific date and location for these hearings will be established after consultation with State representatives. Our desire would be to conduct such hearings early in the spring of 1983.

While a great deal of attention has been focused recently on the implementation of the Act, significant and impressive technical progress in the R&D program continues to be made. FY 1982 and early FY 1983 produced many major accomplishments in the site exploration phase of the three primary geologic media being considered for the first repository; basalt, tuff, and salt. In basalt, an exploratory shaft site was selected and the NEPA documentation was completed prior to the enactment of the NWPA. The principal borehole was drilled to the desired repository level and confirmatory hydrologic testing was initiated. Designs needed to start the exploratory shaft were finalized, and construction was started with the drilling of the starter hole in November 1982. In tuff, the conceptual design for an exploratory shaft was completed and a location for the shaft was selected. Drilling and testing of several boreholes to understand the geohydrologic conditions continued. The principal borehole was started and completed. In salt, project exploration achieved definition of specific locations and preliminary study plans in the Gulf Coast salt domes and in the Paradox Basin bedded salts of Utah. In the Palo Duro basin of the Texas panhandle, small areas were defined, and an extensive series of deep drill holes and geophysical tests are nearing completion according to a DOE/State agreement. A waste package conceptual design and the preliminary salt exploratory shaft design were completed.

As part of the Department's efforts in support of the siting of a second repository, the organization of crystalline rock site exploration has been strengthened by establishment of a field project office. Regional literature based geohydrologic data surveys will be completed in the latter part of the FY 1983 in seventeen states in the eastern United States. These studies will culminate in the defintion of specific rock units for field studies in FY 84 and beyond.

Numerous public meetings have been held throughout the year to explain our efforts to state officials and the public.

In FY 1984, the program begins a transition from the research phase to the engineering development phase. In basalt, drilling of an exploratory shaft will be completed and repository design studies will continue. In addition, at depth testing in the preferred repository region will be initiated. In tuff, the exploratory shaft mining will be inaugurated. Confirmatory site characterization will continue. In salt, drilling at the location of an exploratory shaft will start and site specific hydrologic and geologic testing will continue Additionally, R&D will continue on waste package design, materials characterization, and transportations studies. The aim of this overall work is to develop the data to assist a Presidential site selection and subsequent repository license application for a first repository in the mid to late 1980's.

With regard to the Test and Evaluation Facility, the Department is currently evaluating the role, benefits, and costs of the TEF and whether or not to collocate it at the repository site. Public Law 97-425 requires the Department to present to Congress within one year of enactment, its recommendations regarding the location of the TEF. The Department has initiated an evaluation of the the role and benefits of the TEF with respect to its timeliness and its capability to provide additional information to resolve generic and site specific technical issues (engineering and siting) via insitu tests using up to 100 canisters of high-level waste. The advantages (such as site specific information, design optimization, and performance verification) and disadvantages (such as timeliness of TEF construction relative to repository site identification, licensing schedules, and funding and manpower requirements) of collocation vs. noncollocation (which will not yield site specific information, but could provide earlier TEF construction start) are currently being evaluated.

I also wish to describe those activities which do not qualify for financial support from the fund but directly involve the Project Office. These activities include Terminal Isolation Generic Research and Development, and supporting studies.

Generic R&D

The objective of the Commercial Waste Management program is to support technology related to the long-term management and disposal of commercial radioactive waste. Specific activities include: (1) basic generic R&D for the geologic disposal of commercial waste; and (2) studies to support the combined commercial waste management activities, and obtain international and technical review coordination.

The FY 1983 repository siting activities include development of measurement methods for laboratory testing of host rocks and radionuclide migration through rocks. An integrated generic performance assessment model to predict potential release and migration rates from a repository will be developed. The preliminary waste acceptance criteria and specifications will be defined. The FY 1983 repository development activities include completing development of and testing of repository sealing and backfill systems. Equipment and instrumentation for in-situ testing and performance monitoring will be developed and tested.

The only generic R&D efforts remaining in the Terminal Isolation program in FY 1984 are associated with alternative disposal concepts R&D which currently is the subseabed research effort. This effort is directed toward establishing the feasibility of the subseabed disposal concept. If feasibility is established, it will provide the basis for removal of institutional restrictions on disposal in subseabed. In FY 1983 a technical status report will focus on the critical feasibility issues for the subseabed activities including the completion of sediment models for predicting the effects of emplaced waste. A free fall test, boosted pentrometer tests, and an in-situ heat transfer experiment will be designed. These tests are precursor to determining the feasibility of the actual subseabed disposal. These efforts will lead to the completion in FY 1991 of the assessment of this disposal concept's feasibility.

Supporting Studies

The Supporting Studies task includes three main areas of effort: international program support, special technical reviews by prestigious scientific groups, and independent assessment of programmatic and institutional issues. The thrust of these efforts is to assure mutually beneficial cooperation, to provide an independent assessment of the technical adequacy of the program, and to evaluate potential alternatives which could improve the cost, schedule, or technical aspects of the Commercial Waste Management programs. During FY 1984 the International program efforts will support international, bilateral, and multilateral agreements. Summary reports will be prepared on the various international programs of the various countries emphasizing the status and planning of international waste management activities. International cooperation on experimental projects and exchange of information provides the fundamental basis for many other countries to resolve the pressing issue of disposal of Nuclear Waste. The information exchange contributes to the development of an international consensus on the adequacy and safety of geologic disposal of Nuclear Waste.

Also, in FY 1984, support of special technical reviews by the National Academy of Sciences will continue. Effort will also continue on independent assessment of technical and programmatic issues related to the integration and conduct of the Waste Management and Fuel Cycle activities.

As I mentioned earlier, the Act requires major efforts in two program areas: Disposal and Storage. Having discussed the former, let us now consider the programs for Monitored Retrievable Storage and Interim Storage of Spent Nuclear Fuel.

Monitored Retrievable Storage

The Department is directed to complete by June 1, 1985, a detailed study of the need for and feasibility of construction of one or more MRS facilities and to develop the specific proposal required under Subtitle C of the Act.

This proposal is to include:

1. A proposal for the construction of one or more monitored retrievable storage facilities. The proposal is to contain at least five alternative site-specific designs at a minimum of three different sites.
2. An accompanying Environmental Assessment.
3. Establishment of a Federal program for the siting, development, construction, and operation of MRS facilities.
4. A plan for funding the construction and operation of MRS facilities such that the costs are borne by the generators of the spent fuel and waste.
5. A plan for integrating the MRS with repository and spent fuel storage facilities.

Establishment of the capability to timely deploy a Monitored Retrievable Storage system is a prudent addition to the overall nuclear waste strategy. It would allow the Government to guarantee acceptance of spent fuel and high level waste on a fixed schedule in the event there are unanticipated delays in the geologic repository program.

The Department recognizes the specific products required for the MRS proposal and will complete the proposal and supporting documents for construction of one or more MRS facilities by June 1, 1985. For the first such facility, the proposal will include at least three alternative sites and at least five alternative combinations of sites and facility designs. These will be site-specific designs, with specifications and cost estimates sufficient to solicit construction bids, support Congressional authorization for construction and enable completion and operation as soon as practicable after authorization. The June 1985 submission will provide Congress detailed site-specific plans and alternatives to be considered over the same time period that Congress is considering the first repository site.

The Department's FY 83 budget includes $3.5 million plus $600K of unexpended FY 1982 funds for work in the MRS area. The 1983 efforts will focus on the selection of specific storage concepts based, as much as possible, upon the previous MRS studies conducted by the Department and industry. The report describing the research and development activities necessary to develop the required proposal will be prepared and submitted to Congress in July 1983.

Since the Department's FY 84 budget was prepared prior to enactment of the Act, no FY 84 funds for MRS were requested. A budget amendment to enable the Department to proceed with developing the one detailed design for its preferred site/concept option and conceptual designs for the four alternate site/concept options; the environmental assessment including a comparison of the five design/site options; and the supporting Monitored Retrievable Storage system plans.

Spent Fuel Interim Storage

Implementation of the spent fuel storage provisions of the Act is predicated upon the primary responsibility for storage remaining with the utilities. Federal actions are limited to: 1) encouraging and expediting effective use of existing at-reactor storage capacity through research, development, and demonstration along with consultative assistance and; 2) providing up to 1900 metric tons of Federal storage for use by utilities who have been certified by the Nuclear Regulatory Commission as having exhausted other reasonable alternatives.

1. Spent Fuel Storage Research, Development, and Demonstration Activities

As directed by the Act, DOE intends, within one year, to enter into a cooperative agreement with one to three utilities desiring DOE assistance in at-reactor demonstrations of spent fuel storage technologies. A DOE "Solicitation for a Cooperative Agreement Program (SCAP)" is in preparation for issuance in the near future. This solicitation will describe the scope of DOE assistance to be provided and invite utility proposals. FY 1984 activities will consist primarily of implementation of these new agreements.

These new agreements will supplement activities currently underway under existing cooperative agreements with the Tennessee Valley Authority that provide for the demonstration of rod consolidation equipment and the use of two new storage casks suited for Boiling Water Reactor fuel. It is planned for these demonstrations to commence at TVA in 1984 upon receipt of an NRC license.

In support of the at-reactor demonstrations, DOE is authorized to do demonstrations for dry storage at DOE sites using up to 300 metric tons of spent fuel. The scope and size of this program will be determined based upon discussions with NRC and the private sector and upon responses to the SCAP dealing with this aspect of the program. Depending upon the scope and timing of specific proposals that are accepted, data collection efforts could be initiated in FY 1984 in addition to modification of Federal sites to implement this program.

Several generic spent fuel storage R&D activities are already being conducted by DOE and will continue in FY 1984. Summaries of these activities and planned new activities will be communicated to the utilities to obtain comments and identify any new R&D needs. Generic R&D activities include investigations of fuel integrity under various storage conditions and the development and refinement of analytic tools for predicting the performance of fuel and storage components for use in licensing proceedings and as needed by the spent fuel storage technical community.

2. Federal Storage

The Act assigns the responsibility to DOE for interim storage of spent nuclear fuel from those civilian nuclear power reactors that cannot reasonably provide storage needed to assure their continued, orderly operation. The capacity provided by this program shall not exceed a total of 1900 metric tons. Following an NRC determination of a utility's eligibility for interim storage, DOE will enter into contracts with the utility, take title to their fuel, provide the storage capacity for this fuel at a DOE site, ship the fuel to the storage site (using private industry under contract to provide these services), and store the fuel pending availability of disposal or other storage facilities. FY 1983 activities will focus on submission of an interim storage fee study to Congress by July 1983, preparation of an Annual Storage Plan to be submitted to Congress by January 1984, studies leading to the selection of technology and site options for deployment of Federal storage, interactions with State and tribal governments as necessary, and other activities to support the above. The NRC, possibly in early FY 1984, could determine that several utilities are eligible for Federal storage; in which case DOE could enter into contracts and begin collecting fees for this storage later in FY 1984. We are currently reviewing the possible options for storage identified in the Act to determine specific storage options to be selected.

Other FY 1984 activities will consist primarily of a continuation of activities initiated in FY 1983 as well as initiation of new activities leading to the actual deployment of storage options if contracts are signed.

One additional item I wish to cover is the planned activities with respect to Section 223 of the Act.

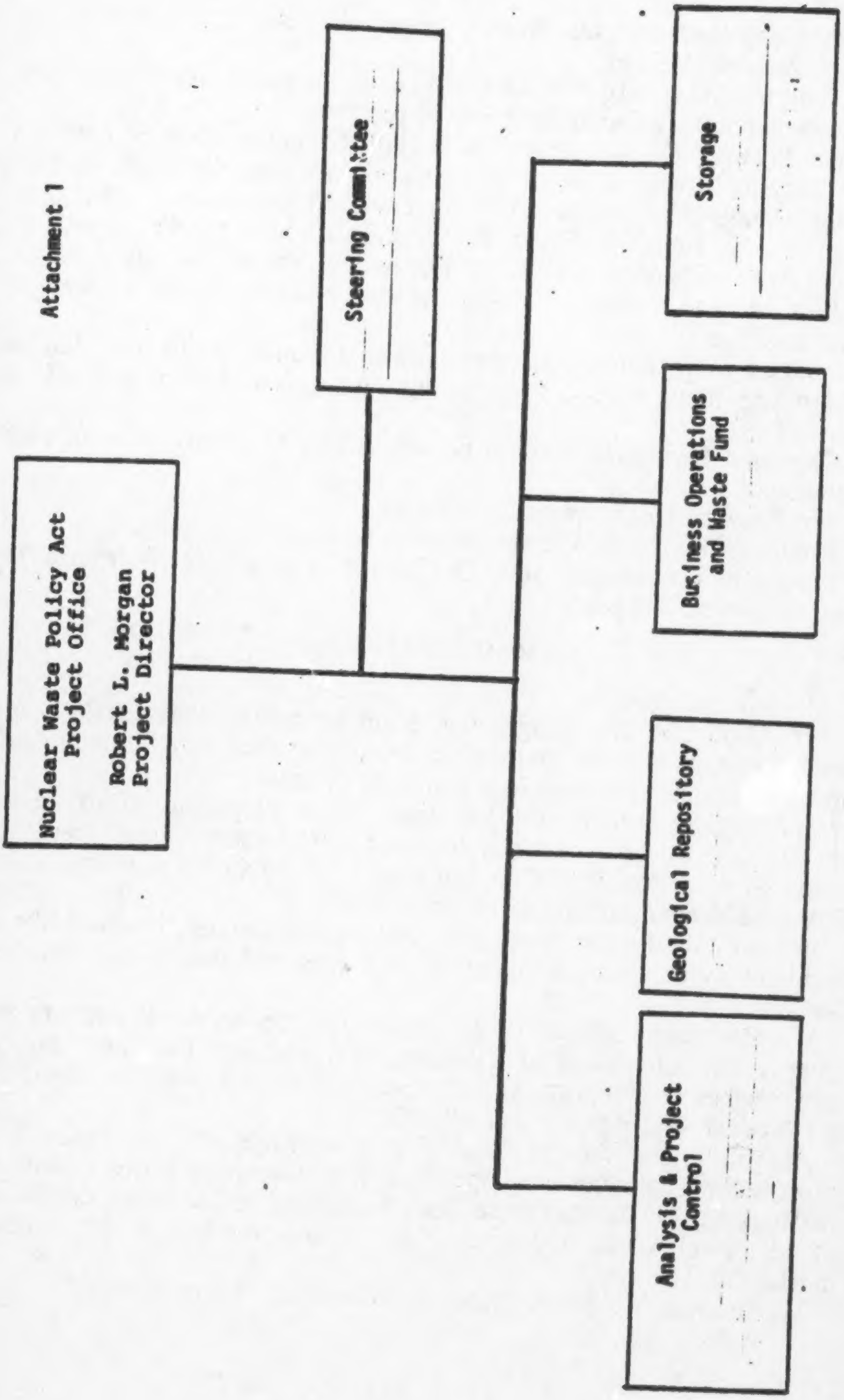
Technical Assistance to Nonnuclear Weapon States

The Act stipulates that it shall be the policy of the United States to cooperate with and provide technical assistance to nonnuclear weapon states in the field of spent fuel storage and disposal. The Act requires that by April 7, 1983, the DOE and NRC publish a joint notice in the Federal Register announcing this policy. The notice will also summarize activities being proposed for international cooperation. This cooperation will not include the transfer of any foreign spent fuel to the United States for storage.

Following publication of the notice, the Secretary of State will solicit expressions of interest from the appropriate governments concerning their participation in the program. Implementation of this offer could begin in FY 1984.

In closing, Mr.Chairman, I solicit your continued support and cooperation so that the major national objectives of the Nuclear Waste Policy Act of 1982 can be implemented effectively and on time.

Attachment 1


Nuclear Waste Policy Act
Project Office
Robert L. Morgan
Project Director
Steering Committee
Storage
Business Operations
and Waste Fund
Geological Repository
Analysis & Project
Control

INTRODUCTION OF ASSOCIATES

Chairman Hatfield. Dr. Brewer, are you the leadoff gentleman?

Mr. Brewer. Yes, sir.

Chairman Hatfield. Would you like to introduce your colleagues. We are happy to welcome each one of you here.

Mr. Brewer. On my far left is Gordon Chipman, Deputy Assistant Secretary for Breeder Reactor Programs; on my immediate left, William Voigt, Deputy Assistant Secretary for Uranium Enrichment and Assessment; on my right, Dr. Frank Coffman, Director of the Office of Terminal Waste Disposal and Remedial Action; on my far right is Mr. Robert Morgan, who is Director of the Nuclear Waste Policy Act Project Office.

I have a rather lengthy statement which I would like to offer for the record and then proceed to summarize for a few moments, if that is satisfactory.

Chairman Hatfield. We will be very happy to receive your 67-page statement.

Mr. Brewer. I don't propose to read it.

Chairman Hatfield. We are happy to have you summarize it.

I want to congratulate you, Dr. Brewer. You are down from a 75-page statement last year.

SUMMARY OF STATEMENT

Mr. Brewer Yes, sir.

Mr. Chairman, the budget that I am proposing today reflects our acute attention to a few major objectives rather than an endless research and development program in a multitude of areas.

Our purpose is to get the job done, not to perpetuate effort. In the agenda that we have laid out for your consideration, fiscal year 1984 holds no surprises. It is a continuation of the four-point policy which President Reagan articulated in October 1981.

Before I discuss the fiscal year 1984 budget request, I would like to highlight some accomplishments since I appeared before you this time last year.

We have made substantial progress, I believe, on the President's nuclear policy objectives of October 1981. Perhaps the most notable achievement of Congress, and the executive branch, was the passage of the Nuclear Waste Policy Act of 1982.

As you know, the act establishes a schedule and an institutional process for deploying a comprehensive management waste system for the back end of the fuel cycle, both for storage and ultimate disposition of high-level waste and spent fuel. It also establishes the funding mechanism.

Mr. Morgan will be testifying on this subject in a moment.

CLINCH RIVER BREEDER REACTOR

The President, as you know, has endorsed completion of the Clinch River Breeder Reactor project. When I appeared before you last year, we had not yet begun work on the site for the Clinch River Breeder project. We had promised to shave time and expense off of the front end of the schedule, but we, at that time, had not gained NRC permission to start.

I am happy to report that since that time we have started and nearly completed site preparation activities as shown on chart 1. Further, the NRC safety and environmental reviews are proceeding very well and we expect to be granted a full construction permit later this year.

There were other Clinch River Breeder accomplishments this past year. There was steam generator procurement and we achieved a fixed cost contract for the nine plant units at a cost of about one-third of the cost of the prototype.

The prototype, incidentally, was finished and is now under test in California, as shown in chart 2.

NUCLEAR LICENSING

Another element of the President's civilian nuclear policy is the objective of streamlining and stabilizing the nuclear licensing process without a reduction in safety of nuclear facilities.

The safety record of civilian power facilities is excellent, but the uncertainty attending the licensing process has been a major factor in driving off commercial investment.

We have prepared a proposal for stabilizing the licensing process and will be taking action on that shortly.

Mr. Chairman, there are also a number of other past-year accomplishments not so directly related to the President's civilian nuclear policy, and I would just like to mention a few.

THREE MILE ISLAND

As you know, at TMI our policy is to conduct, first of all, research and development of generic benefit to nuclear powerplants, and, second, to take action where we have statutory responsibility or unique capabilities to handle unique waste.

We do not have responsibility for accepting on the part of the taxpayers the total financial burden for the cleanup.

We have, however, performed a nonbudget role of serving as a catalyst in facilitating an equitable financial solution in support of Governor Thornburgh's formula.

In addition, about 1 year ago, DOE signed an agreement with General Public Utilities and Governor Thornburgh to take responsibility for the damaged fuel.

Our effort in removing, transporting, processing, and disposition of the damaged fuel will be accomplished on a total cost-recovery basis.

The only Federal taxpayer's expense will be to perform the research and development. Chart 3 shows liners being removed from the TMI site.

URANIUM ENRICHMENT

As you know, Mr. Chairman, we have lost our lead position in the foreign market for enrichment services. In 1973, we enjoyed 100 percent of the world market. In 1980, our fraction of the market was down to about 30 percent.

We have in the past year made progress in recovering our position. For example, we signed three contracts, with a potential sale value of more than $1 billion, with Egypt. We have taken steps to prove to our customers and to potential customers that our prices will compete and will be as low or lower in the long term as the competition.

We are pressing ahead with process buildings 1 and 2 at the Gas Centrifuge Enrichment Plant project at Portsmouth, Ohio.

We began during the last year to test a train of centrifuges at the centrifuge test facility at Oak Ridge. Last April, we made a very technically and politically difficult decision to concentrate our research and development efforts on the atomic vapor laser isotope separation process and the advanced gas centrifuge.

Furthermore, to provide more flexibility for our customers and more stability in our entire enrichment strategic planning, we have proposed a new contract form which will be offered late this spring.

Let me turn now, Mr. Chairman, to the fiscal year 1984 budget request. Let me try to place the budget request in perspective.

PROGRAMS MANAGED BY ASSISTANT SECRETARY FOR NUCLEAR ENERGY

The programs which I manage are of several types.

There are programs which have to do with national defense such as the Naval Reactor Program. There are programs which are operational in character as opposed to development, such as enrichment; then there are programs which have a special legislative basis, such as remedial actions programs, TMI, and West Valley.

Another example of such programs is the high-level waste program under the direction of Mr. Morgan, where we have removed the funding drain from the Treasury and replaced it with a user fee.

There are programs which we conduct for other agencies because we have special unique qualifications and facilities. Examples are the space nuclear programs and the naval reactor program.

Finally, there are programs which are developmental. They are related to civilian nuclear systems which have the potential in the long run for commercial application, but which are presently beyond the private sector's ability to finance but which, in fact, promise enormous payback to society.

These are programs which reflect policy choices of the administration and Congress and, as you know, are subject to intensive debate.

NUCLEAR BUDGET

The total nuclear budget, as you can see on the next chart, is $4 billion. If we subtract out the Naval Reactors Program, which is $600 million, and enrichment operations, which is about $2.2 billion, the balance is $1.2 billion.

I might add, Mr. Chairman, that the $2.2 billion for enrichment operations is totally recovered in fiscal year 1984 by revenues from separately reported sales.

Let's start now with the $1.2 billion as the basis for the energy supply R&D appropriation, as shown in chart 6. Of that $1.2 billion, about $330 million is for waste management activities funded by the new waste management bill of 1982.

Remedial actions which, as I said, have special legislative bases, account for about $94 million. That includes mill tailings, surplus facilities, and the like. Advanced nuclear systems, such as applications of nuclear power to space, is a program which we conduct as a service to the Department of Defense and NASA, totaling $34 million.

So, the bottom line is $693 million for programs which are of a commercialization and research and development character.

If we can have the next slide?

As reflected in this slide, I would like to compare the $693 million to previous years. In fiscal year 1982, the comparable number was $790 million. So, you can see there has been a 12-percent reduction between fiscal years 1982 and 1984.

If you exclude Clinch River, Mr. Chairman, the reduction is 29 percent between fiscal years 1982 and 1984. There is a slight 3-percent increase between fiscal years 1983 and 1984 overall.

Chairman HATFIELD. Dr. Brewer, you mean $790 million rather than $970 million?

Mr. BREWER. Sir?

Chairman HATFIELD. According to your first column.

Mr. BREWER. $790 million.

Chairman HATFIELD. I thought I heard you say $970 million.

Mr. BREWER. No; $790 million.

Chairman HATFIELD. That compares to the $693 million.

Mr. BREWER. Compared to $693 million. You can see the reduction between fiscal years 1982 and 1983. You can see the displacement of programs in the breeder account by the Clinch River Breeder Reactor funding level between fiscal years 1982 and 1984.

SUMMARY OF NUCLEAR ISSUES

Mr. Chairman, the issue I believe which will dominate the congressional fiscal year 1984 season are those Reagan policy initiatives which have yet to be installed or implemented, such as licensing reform, the Clinch River Breeder Reactor funding and innovative financial requirements, a report of which we must have to you on or before March 15, reprocessing, the fate of Barnwell, and implementation of the Waste Act.

We had a very busy, productive year last year and I expect the nuclear agenda for fiscal year 1984 will be no less contentious this year.

In Clinch River, we face a very major challenge. As we have all asserted many times in the past several months, we must find a way to get as much of the remaining cost as possible away from the annual appropriations cycle.

We will provide a report to Congress describing one or more of the budget concepts by the middle of March. The utility partners have formed a task force of the best financial brains in the business and we have provided guidance on the general target area of the off-budget performance.

I would not like to prejudice their efforts with an elaborate discussion today of what they are considering.

As for Barnwell and reprocessing, what is urgently needed is a stable policy and regulatory environment in which reprocessing will occur by normal market forces in the private sector.

We have not accomplished this. We have considered with industry innumerable options and scenarios, but this has not been reduced to specific negotiations.

Time is running out at Barnwell if Barnwell is to be the vehicle. Our problem is that in dealing with suggestions and formulations in the abstract we need a definite proposal to operate on and we need it soon.

Mr. Chairman, this concludes my oral remarks and I will be happy to respond to whatever questions you may have.

NUCLEAR WASTE POLICY ACT

Chairman HATFIELD. Thank you, Dr. Brewer.

Can we proceed to take the testimony of Mr. Morgan and then we can come back to the question period.

Mr. Morgan. Thank you, Mr. Chairman.

First, I would like to cover briefly the objectives of the Nuclear Waste Policy Act of 1982, which is the construction of repositories for permanent disposal of nuclear waste by 1998, submission of a proposal for the construction of one or more monitored retrievable storage facilities by 1985, and assisting utilities in the development and licensing of additional reactor storage capacity and emergency minimum storage.

In the area of geologic repositories, we are required to issue general siting guidelines within 180 days of enactment of the act. Proposed guidelines were published in the Federal Register on February 7, and have been sent to the States and other agencies. We will have public hearings on the proposed guidelines this month.

The next item is to identify the States with potential sites and notify the States by April 1983. Six States were notified by the Secretary on February 2. We plan to hold public hearings in these States with potential sites by this summer; then to nominate five sites and then recommend three sites to the President by late summer 1983.

Regarding the test and evaluation facility, we intend to submit a report on whether or not to colocate the test and evaluation facility and repository by January 1984.

In the monitored retrievable storage area, we are to submit an R&D plan and report to Congress by July 7, 1983, and complete the required studies, plans, and assessments and submit a proposal for construction by June 1, 1985.

We do intend to comply with those requirements within the law, sir.

In the R&D program for spent fuel, we are to select one to three reactor sites for licensed cooperative demonstrations with utilities by January 7, 1984, and we have already solicited proposals from the utilities. We intend to conduct a demonstration program using up to 300 metric tons of spent fuel at Federal sites, and conduct generic R&D.

In the Federal interim storage program, DOE will provide up to 1,900 metric tons of spent fuel storage capacity where the at-reactor capacity is determined insufficient by NRC and a fee study is to be submitted by July 7, 1983.

In the international cooperation area, DOE and NRC will publish by April 7, 1983, a joint notice to cooperate with, and provide technical assistance to, nonnuclear weapons States, when appropriate.

In the funding area, on the budget summary under the nuclear waste fund, the 1984 request is $306.7 million; for commercial waste management, which is the line item for the project office responsibility, we are requesting $6.3 million; the spent fuel technology line item request is $5 million, for a total of $318 million.

Looking at that $306.7 million number, there are four areas of concern in the 1984 budget. There is no funding in the fiscal year 1984 budget as submitted for the test and evaluation facility. There is a questionable number for the crystalline rock program stated on this line as other media; the Federal and State assistance line item we are reviewing because of potential impact assistance we must provide the States and we are submitting an amendment to the 1984 line item for the monitored retrievable storage (MRS). That number currently is projected to be approximately $12 million.

Most of the nuclear waste commercial program budget is now carried under the waste fund, so the alternate disposal concept is the primary item that we have here, which is the subseabed program and the supporting studies of $1.6 million. The last is the spent fuel technology budget for a total of $5 million. I would be happy to answer any questions, sir.

CLINCH RIVER BREEDER REACTOR

FUNDING ALTERNATIVE

Chairman HATFIELD. Thank you very much, Mr. Morgan.

Dr. Brewer, as you know, the continuing resolution instructed the agency to explore proposals including reconsideration of the original cost-sharing program, to seek ways to reduce the Federal budgetary involvement, and to increase participation from the private sector.

As I understand, originally the utilities or the private sector was to share about 50 percent of this and if I am not mistaken, the utility contribution, at the present time, is only about 10 percent of the total cost.

Mr. BREWER. That is roughly correct, Mr. Chairman.

The first estimate was, I believe, $699 million, with a utility pledge of about $255 million; so roughly half of the original proposal in the early seventies was a utility contribution.

Chairman HATFIELD. And this report is due on March 15?

Mr. BREWER. Yes, sir.

Chairman HATFIELD. Can you give us any kind of insight or preliminary findings that might be addressing this particular subject or this particular question that will be included in the report?

Mr. BREWER. I would like to avoid, Mr. Chairman, prejudicing the utility task force report. I will say, however, that one of the basic concepts is to make use of the equivalent commercial value of the 375-megawatt plant, a plant of that size operating on a commercial utility grid in the year 1995, and, in some fashion, try to prefinance that value.

Chairman HATFIELD. In your testimony, you indicate that the industry commitment is "no longer sufficient." Let me put the question this way, then. Has there been any indication that that sufficiency might increase; that is, to get sufficient participation. Can we expect to see some improvement? Has there been any indication to you, any signals that private industry is going to increase their participation?

Mr. BREWER. There is certainly a great deal of moral support for the project in industry and among the utilities. The difficulty is, as you know, converting that into dollars and, in particular in the case of our utility partners, getting contributions into the rate base in their State public utility commissions.

Chairman HATFIELD. What about the nuclear equipment manufacturers from the private sector, reactor manufacturers or people who would be doing that kind of work, has there been any increased interest in their segment?

Mr. BREWER. Yes, there has been. I cannot calibrate it with a specific dollar figure for increased funding.

Chairman HATFIELD. Increased moral support?

Mr. BREWER. Moral support and indications that owing to the future commercial value of the technology in the decades ahead, there may be some validity in greater private reactor manufacturing investment in the project if we can guarantee that the Clinch River Breeder Reactor can get built on time.

Chairman HATFIELD. Of course, I respect Dr. Schlesinger has his testimony to the fact that there may not be that kind of commercial value coming from the Clinch River Breeder Reactor. That is a number of years ago. So, if it is contingent upon that factor emerging out of this controversial project, is that much of a base to go on?

Mr. BREWER. The Clinch River is a developmental project. It is one step in the scale-up sequence to plants of commercial size such as 1,000 to 1,200 megawatts. One would probably not replicate that size using the exact design of Clinch River.

Chairman HATFIELD. Do we expect to get the report on time on March 15?

Mr. BREWER. Yes, sir.

We are determined to supply you with the report as directed by the continuing resolution.

TERMINATION COSTS

Chairman HATFIELD. Dr. Brewer, if funding should not be provided in fiscal year 1984 for the Clinch River Breeder Reactor, and that is always a possibility, as you know—we fight that battle every year, and the opponents are going to win one of these days. But if continued funding is not provided, what would be associated termination cost? What would be the additional budget authority that you would require to terminate this project and if you do not have that, could you supply it for the record?

Mr. BREWER. Yes.

Chairman HATFIELD. I would like that in specifics, too.

Mr. BREWER. Yes, sir; we have it itemized by various components and can provide that information for the record.

[The information follows:]

CRBRP TERMINATION ESTIMATE

Depending on whether the termination is done abruptly or in an orderly closeout to take advantage of the funds already spent, the termination costs would range from $150 to $489 million. These estimated termination costs are in addition to the sunk cost of over $1.4 billion—at the end of fiscal year 1983—in Government funds that would be lost if the project were canceled.

Abrupt termination activities would take $150 to $175 million. A closeout including the completion of only selected system designs and a final report would add about $40 million. An additional $100 to $125 million would be needed to complete the remainder of the design. Thus, an orderly closeout would cost about $290 to $340 million. Furthermore, the Government may be liable for repayment of the utility contributions that are expected to reach $149 million in fiscal year 1983. Therefore, the termination costs could be as much as $439 to $489 million. Considering the budget authority estimated to be available from prior appropriations at the end of fiscal year 1983, approximately $46 million—a minimum of half of the fiscal year 1984 request—would be required even in an abrupt, immediate shutdown, and the total request would be required if the payback of utility contributions is required.

CLINCH RIVER BREEDER REACTOR

Chairman HATFIELD. Let me have a followup to the questions I was asking Dr. Brewer. Did I understand you to say that in the March 15 report there may be one or more of budget options for the Clinch River Breeder Reactor?

Mr. BREWER. There will be, Mr. Chairman, a conceptual, a financial, conceptual scenario that will not be in the form of a specific negotiated out transaction.

Chairman HATFIELD. I am not sure I understand your answer.

Mr. BREWER. It will be a financial concept for a greater private sector equity share in the Clinch River project. It will not be a completely negotiated out deal with a private entity with contracts.

Chairman HATFIELD. It is merely taking the Clinch River funding from on budget to off budget?

Mr. BREWER. Getting the financial burden away from the U.S. Treasury.

Chairman HATFIELD. I appreciate that. I hope that means substantial increase in the participation from the private sector. But if it is merely a taking of the Clinch River project off budget, those off budget, that is an illusion, these on budget, off budget programs. I think, frankly, that that is a very poor procedure that we have tended to create here in the Congress. I am not going to participate in the expansion of that type of thing because we have gotten into all kinds of difficulties with SPRO as you know and other programs that "off-budget" as if they had no budgetary implications.

Mr. BREWER. Mr. Chairman, when I say "off budget," I do not mean something analogous to a user fee such as the waste program.

Chairman HATFIELD. We will be looking forward to seeing that.

ADDITIONAL PREPARED QUESTIONS FOR THE RECORD

I have a number of other questions that I would like to submit for the record and have you respond if you will, please. My right arm and left arm are here in this case. I am sure Senator Johnston will have some questions that he might wish to ask.

[The questions and answers follow:]

Questions Submitted by Senator Hatfield

Clinch River Breeder Reactor Plant

Question: In FY 1984, your request proposes to further licensing, to complete site preparation, and to initiate construction of the Clinch River project. Please provide for the record the amount requested for each of these activities.

Answer: The breakdown of FY 1984 funding--budget authority--requested for these items is as follows:

Construction	$ 91,000,000
Hardware	115,000,000
Engineering, including Licensing, and Project Office	64,000,000
Total	$270,000,000

Site preparation will be completed using carryover funding already appropriated.

Question: For the record, please provide a breakdown of each element of site preparation and construction activity planned in FY 1984 and the estimated start and completion for each task.

Answer: If the level of FY 1984 funding for the CRBRP is $270 million as requested, and construction is authorized by the NRC, then these activities and their estimated schedule will be as follows:

Activity	Start	Completion
Excavation	Started	November 1983
Leveling and Mud Mats, Vertical Backfill Concrete, Waterproof Membrane	September 1983	December 1983
Barge Facility	October 1983	January 1984
Railroad	October 1983	May 1984
On-Site Office Building	November 1983	June 1984
On-Site Warehouse	November 1983	March 1984
Start Nuclear Island Mat, Including Cell Liners	December 1983	Continues
Sewage Treatment Plants	January 1984	March 1984
Containment Vessel Erection	August 1984	Continues

Question: If funding to continue the project is not approved in FY 1984, what are the estimated costs of termination and how much additional budget authority would be needed to meet these costs? Please provide specifics.

Answer: Depending on whether the termination is done abruptly or in an orderly closeout to take advantage of the funds already spent, the termination costs could range from $150 to $489 million. These estimated termination costs are in addition to the sunk cost at the end of FY 1983 of over $1.4 billion in Government funds that would be lost if the project were cancelled. Abrupt termination activities would take $150 to $175 million. A closeout including the completion of only selected system designs and a final report would add about $40 million. An additional $100 to $125 million would be needed to complete the remainder of the design. Thus an orderly closeout would cost about $290 to $340 million. Furthermore, the Government may be liable for repayment of the utility contributions that are expected to reach $149 million in FY 1983. Therefore, the termination costs could be as much as $439 to $489 million. Considering the budget authority estimated to be available from prior appropriations at the end of FY 1983, approximately $46 million, half of the FY 1984 request would be required even in an abrupt immediate shutdown, and the total if the payback of utility contributions is required.

Large Scale Prototype Breeder

Question: What is the anticipated size of the large scale breeder demonstration plant and the expected cost?

Answer: The Large Scale Prototype Breeder, or LSPB, as currently envisioned will have a capacity of approximately 1000 MWe gross. A cost estimate for the LSPB will be determined by DOE and the utilities as they advance several different design concepts during the consolidation phase in FY 1983 and FY 1984. These concepts will be narrowed based on the criteria of least cost, reasonableness of technical risk, and ability to obtain foreign cooperation. Cost and schedule estimates for LSPB will be available at the end of the consolidation phase.

Question: In your opinion, how much will the federal government spend on design, planning, or other activities for this project?

Answer: An objective of the LSPB implementation planning is to obtain the maximum possible private sector contributions for design and construction. At this early stage of planning, it is not possible to determine what the exact private sector and federal government contribution will be, but it is the Administration's objective to have the financial responsibility of the LSPB assumed principally by the private sector.

Question: Please explain the activities to be funded with the $15 million requested in FY 1984.

Answer: The $15 million required for FY 1984 will be used to support a cooperative effort with the private sector which will include conceptual design, foreign cooperation planning, and implementation planning, that is, identification of financing alternatives and the like, for LSPB. The contractors participating include Westinghouse-ARD, General Electric-ARSD, Rockwell International, Combustion Engineering, Burns and Roe, Bechtel, and Stone and Webster.

Base Breeder Program

Question: Please comment on your plans started, I believe, in FY 1983 to refocus and consolidate the LMFBR base program.

Answer: In our testimony supporting the fiscal 1983 budget request, we indicated a planned reduction from 23 to 11 contractors.

Generally the efforts at these contractors, less than $200,000 per contractor, have been consolidated into the mainstream laboratories and contractors, thus producing a more efficient and manageable program structure. Indications are that a greater consistency and dedication to purpose has been realized.

The consolidation effort also created a very logical opportunity to reconsider the relationship between the program and participating universities. As a result, the interaction level has been focused at the laboratory or industrial contractor level, that is, the point at which the technical work gets done. Our current estimate is that, as a result of this action, the number of universities participating in the breeder base program could be increased from 5 to 25. The net result is a dramatic increase in the number of students and faculty actually participating and a better utilization of talents and laboratory resources--large tasks for large labs, small tasks for small labs--including improved university awareness of the purposes and capabilities of the breeder.

The consolidation effort has enabled more optimum funding profiles, particularly in the case of large components. Completion and delivery schedules are being firmed up. Slippages are being overcome, and test facility planning and use are being improved.

Finally, consolidation has enabled better support of the mainline industrial contractors, including stabilization of payrolls and more consistent forward planning and program assignments. The importance of such stabilization can hardly be overstated. The management burden of continual replanning and shuffling of resources is a serious distraction from the more important task of managing and promoting creativity in research and development programs. The instability also leads to serious morale problems with individual scientists and engineers and causes a distraction of their mental faculties away from research and development activities toward more personal considerations.

Although such factors are difficult to quantify, their consequences are readily discernable when one reviews the productivity of the program. In the past year, mainline laboratory and contractor personnel have translated from worry to achievement. Some of the more obvious results include:

- Sustained operation of Fast Flux Test Facility.
- Startup of Clinch River prototype steam generator testing.
- Completion of Phase I Clinch River main coolant pump testing.
- High throughput of experiments in the Transient Reactor Test Facility.
- High capacity factor at the Experimental Breeder Reactor-II in spite of down time for repair and modifications.
- Intensification of foreign interest in breeder base program activity.
- Major improvements in the scope and depth of cooperation between national laboratory and participating industrial contractors.

All of the above and more have occurred during this consolidation phase. It is difficult to pin point the extent to which consolidation has been responsible, but it is clear that consolidation necessitated much stronger interorganizational communication, and that this improvement in communications laterally and vertically was brought about by the consolidation effort and the means by which it was accomplished.

Question: Secretary Hodel stated that "If we do not proceed with Clinch River, we will have to evaluate which of these efforts (in the base breeder program) must continue and at what levels." Would you care to comment--give us some idea generally of elements in the base program which would be reduced?

Answer: Individual research and development requirements in the Clinch River Project fall into two categories: firstly, those unique to the specific requirements of the Clinch River Project, and secondly, those in common with the base technology program. Research and development unique to the Clinch River Project is funded by the Clinch River Project. There are, within the base technology program, a total of 96 individual development requirement specifications. These are tasks funded by the base program, the results of which are needed both by the base program and by the Clinch River Project. These individual activities are in the areas of systems and component development and testing, reactor safety, physics, fuels, and structures. Important examples are proof of fuel absorber and blanket performance, core restraint and seismic design, system containment integrity, instrumentation and control, safety design and regulatory issues, and effectiveness of safety systems.

Only that R&D unique to the Clinch River Project and funded by it would be eliminated if the Clinch River Project were not to proceed.

LWR Extended Burnup Program

Question: Discuss the reasons for reducing the extended burnup program. In your view, will private industry assume a greater share of the program? Please indicate the internal DOE request to the Secretary and the DOE request to OMB for this program.

Answer: Based on the Administration's general policy of minimizing federal involvement in R&D activities which can be done by industry given sufficient incentives, the extended burnup of LWR fuel will be phased down through the Department's continuation of only one major project plus supporting small-scale generic R&D, and through the private sector's possible acceptance and conduct of part of the Department's previously planned program without government assistance.

It should be noted that there exist industrial interest and meaningful privately funded R&D on extended burnup fuel. Therefore, the Department should reduce its involvement in this kind of work; that is, on a reactor system which has already been commercialized.

To date, the private sector's participation in the extended burnup program has been limited to the cost- and risk-sharing of ongoing projects that have been largely supported by the Department and approximately $2 million annually of complementary private sector funding through Electric Power Research Institute. In most of the DOE cost- and risk-shared contracts, utilities serve as prime contractors and fuel suppliers serve as subcontractors. The utilities accept the risks of any unanticipated effects of their project on their facilities, such as fuel failure or plant downtime, and in addition often contribute the manpower costs of their personnel engaged in management of the project. The fuel suppliers do the vast majority of the detailed work and generally contribute past privately funded work, and in a small number of cases contribute partial funding of the work. All utilities and fuel suppliers in the program have contributed waiver of their fees.

An examination of industry's incentives is necessary to understand their reluctance to commit to more sizeable, longer-range investment in this kind of R&D, even though they strongly support it. The utilities have strong incentives for implementing available technology to extend burnup, since this directly benefits their consumers through the customary fuel-cost pass-through clauses. The fuel suppliers will supply fuel incorporating available technology, to the extent it is demanded by utilities. However, neither the fuel suppliers nor the utilities have any long-range incentive to invest in the necessary R&D for developing new technology in this area. The fuel suppliers lose volume of business and incur greater warranty risks through burnup extension, while the utilities incur greater operational risks but must pass the financial benefits gained through to their ratepayers. The position of the Electric Power Research Institute is essentially the same as that of the utilities, since the utilities provide the Institute's financial support.

The internal DOE budget request to the Secretary for this program and the DOE request to OMB were both $5.8 million for the 1984 fiscal year.

LOFT International Program

Question: Briefly describe the international program on reactor response and safety at the LOFT facility. What is the total cost and the level of federal, private, and international participation?

Answer: Until recently, LOFT was primarily funded by NRC and performed experiments in support of NRC-specific licensing issues. The new Organization for Economic Cooperation and Development, or OECD, LOFT Project will be jointly funded by eight OECD countries, wherein the United States is represented by both DOE and the NRC. The Electric Power Research Institute is joining as an Associate Member. Program objectives are consequently expanded so as to include international safety issues, operating procedures in accident situations, and the design of commercial plants and their safety systems.

The experiment program includes: a complete and unrestored loss of all feedwater--performed February 20, 1983--small breaks in the primary coolant system, large breaks in the primary coolant system, and simulated accident conditions resulting in the damage of fuel.

The total cost of the program is $91 million, of which NRC had previously planned $40 million for the final portion of its program. Of the remaining $51 million, the U.S. federal government would supply $30 million, U.S. private industry $1.5 million, and foreign sources $19.5 million. It should be noted that $15 million of the $40 million previously planned NRC costs to shutdown and decontaminate the facility are now proposed in the DOE budget making the NRC contribution $25 million and DOE $45 million.

Reduced Enrichment at Research and Test Reactor Program

Question: In the DOE budget, there is no request for funding of the Reduced-enrichment at research and test reactor (RERTR) subprogram. Last year Congress added funds for this project. Briefly describe the benefits of the program.

Answer: The United States is the established supplier of highly enriched uranium, or HEU, and has assured co-signers of the Nuclear

Non-Proliferation Treaty that justifiable requests for its export will be honored. Recently, the United States announced a Non-Proliferation Initiative that will significantly reduce access to U.S.-supplied HEU to fuel research and test reactors.

Both to fulfill these obligations and to implement the proposed policy change, viable alternate fuels of lower enrichment must be demonstrated.

The RERTR Program is developing the technology needed, first, to fabricate and demonstrate performance of several alternate fuels, offering a range of comparable neutron reactivities but significantly reduced enrichments, and second, to assure that, once proven, these reduced-enrichment alternate fuels promptly become commercially available in the international market.

Also, the RERTR Program is providing technical assistance in planning conversions to alternate fuels for those operators not having adequate staff to undertake the conversions on their own. In this respect, the program is instrumental in maintaining the momentum of the international activities that indicate--today--that the desired conversion of most all research and test reactors to fuels of reduced enrichment can be achieved by the end of the 1980's.

The availability of the alternate low enriched uranium or LEU-fuels technology will enable the United States to deny future access to HEU of U.S.-origin without criticism for being an undependable and irresponsible supplier of fuel and thus greatly assist in reducing the proliferation risks associated with worldwide HEU-fuel inventories.

Question: Is there a request for continuation of the program under the Arms Control and Disarmament Agency?

Answer: It is our understanding that the FY 1984 ACDA budget submission for FY 1984 includes funds for the RERTR Program at a level comparable to that requested for FY 1983.

Question: How much is the requested amount and what will be accomplished?

Answer: That amount is about $4.8 million. The major accomplishments are expected to be first, the continuation of irradiation tests of advanced technology fuel specimens to greater than 80 percent burnup of the fissile atoms, and second, the conduct of post-irradiation examinations of high burnup fuel specimens to characterize performance capabilities, and third, selection of a silicide-dispersion fuel composition and initiate procurement for a full core performance demonstration in a high power reactor.

Question: Does this other agency (ACDA) have the capability and expertise to continue the program?

Answer: While ACDA will provide budgetary support for the RERTR Program in FY 1984 and beyond, DOE will continue to have the responsibility for technical administration of this important activity. Furthermore, ACDA funds will be provided through DOE to the Argonne National Laboratory, which will continue, as it has, to carry out the detailed day-to-day management and program coordination roles.

Question: Will DOE personnel be involved?

Answer: DOE personnel in both the Offices of Nuclear Energy and International Affairs will be involved.

Coordination will be assiduously maintained between DOE, having responsibility for technical aspects, and those agencies having lead implementation roles: the Department of State and ACDA in the case of foreign reactors and NRC in the case of domestic reactors.

Uranium Mill Tailings Remedial Action Program

Question: Specifically, how does the Department of Energy (DOE) plan to use the $7 million increase requested in FY 1984?

Answer: The $7 million increase for FY 1984 will be used to support the remedial actions at the first two processing sites, namely, Canonsburg, Pennsylvania, and Salt Lake City, Utah, which are scheduled to begin early in the fiscal year. The amounts budgeted for the remedial action at these sites are $3,575,000 and $3,430,000, respectively.

Question: Please list the sites, work proposed and priority of the work.

Answer: The sites on which work beyond that involved in the completion of the planning and NEPA documentation phases, will be performed are as follows:

Site	Priority	Activities
Canonsburg, PA	High	Remedial action at processing site and vicinity properties
Salt Lake City, UT	High	Remedial action at processing site and vicinity properties
Shiprock, NM	High	Engineering
Durango, CO	High	Engineering; cleanup of vicinity properties
Gunnison, CO	High	Engineering
Grand Junction, CO	High	Cleanup of vicinity properties
Riverton, WY	High	Engineering
Tuba City, AZ	Medium	Engineering
Mexican Hat, UT	Medium	Engineering

Question: How would extending the completion date of the Uranium Mill Tailings Remedial Action (UMTRA) program beyond the 7-year schedule be more "cost effective"? Would this increase and reduce the total federal cost?

Answer: The incentive for considering options for extension of the program is to reduce the high peaks in the funding profile associated with completing the program within the 7-year period authorized by Public Law 95-604, The Uranium Mill Tailings Radiation Control Act of 1978. Preliminary studies have shown that the funding peak of approximately $100 million associated with our initial 7-year plan can be reduced substantially by readjustment of site schedules within the 7-year period.

Initial indications from our studies are that the progam would be most cost effective when conducted on a 7 or 8-year basis. If the program is extended beyond this point, the penalties of outyear cost escalation and of sustained overhead costs become substantial. More specific conclusions from the options studies will be available within a few months.

Question: Please provide the subcommittee a detailed report on the status of DOE activities at Edgemont?

Answer: In response to the enactment on January 5, 1983, of Public Law 97-415, which authorized the Department of Energy to perform remedial action at contaminated properties in the vicinity of the Tennessee Valley Authority-owned uranium mill site near Edgemont, South Dakota, the Department has accorded this activity priority equivalent to that of the highest priority sites in the Uranium Mill Tailings Remedial Action Program, known as UMTRA, and will make every effort to complete remedial action on an initial group of properties during the 1983 construction season.

There are a number of actions that must be completed as prerequisites to the start of the remedial action at Edgemont. These actions, together with a brief description and statement of current status, are as follows:

The first is a Cooperative Agreement with the State of South Dakota. The Uranium Mill Tailings Radiation Control Act of 1978--Public Law 95-604--prescribes that the Department and the State in which remedial action is to be performed shall enter into a cooperative agreement setting forth the basis, such as cost sharing, land acquisition, etc., on which the remedial action is to be performed. The Nuclear Regulatory Commission is required to concur in this agreement.

The status of this is such that the Department is in the process of modifying the model cooperative agreement which has been developed under the UMTRA Program to make it appropriate for the Edgemont situation. In the near future the draft cooperative agreement for Edgemont will be forwarded to the State of South Dakota for their review. Expeditious review and discussion of any required changes will be requested so that completion of the agreement will not delay the start of remedial action. Based on past experience, this item is the one most likely to present a problem with respect to schedule; typically the negotiation of the UMTRA Program cooperative agreements has required from 6 months to 1 year.

The second action is agreement with the TVA. It will be necessary to enter into an agreement under which the TVA agrees to accept the radioactive waste from the vicinity properties and dispose of it, along with the tailings from the processing site, in the repository being developed for that purpose.

The status of this is such that the TVA has indicated informally its willingness to dispose of the waste from the vicinity properties, and no problem with formalizing the agreement is anticipated.

The third action concerns the National Environmental Policy Act or NEPA. The requirements of the NEPA as they relate to the cleanup of the vicinity properties must be fulfilled.

The status of this is such that an Environmental Impact Statement or EIS covering the remedial action to be performed by the TVA at the processing site has been published. We believe that the NEPA requirements for the vicinity properties can be met with the preparation of an environmental report, or possibly an environmental assessment, referencing the above EIS and leading to a finding of no significant impact. No difficulty in completing this requirement in time to preclude interference with the start of remedial action is anticipated.

The fourth action concerns designation. Public Law 97-415 requires the Secretary in consultation with the Administrator, the Commission and the State of South Dakota to designate contaminated properties for remedial action. Such designation is based on an assessment of radiological survey data obtained on a property in terms of the standards which have been promulgated by the Environmental Protection Agency.

The status of this is that the NRC has supported the radiological survey of approximately 970 properties in the Edgemont area, and the NRC staff has advised us that they will provide, within the next 2 months, reports on some 184 of these properties on which some contamination has been identified. We will begin our review of these reports upon receipt and will designate an initial group of properties for remedial action.

The last action involves remedial action contractors. The engineering of the remedial action and the onsite cleanup work will be conducted by contractors to be selected in accordance with established procurement procedures.

The status in regard to this is that we will determine the most effective contractor acquisition procedure, taking into account cost effectiveness, experience, availability, and other pertinent factors. We will make every effort to complete this process on a schedule consistent with the start of remedial action.

As indicated above, much of the planning and preparatory work required is already underway. A meeting among the principal parties that will be involved in the Edgemont Project was held at Tucson, Arizona, on March 1, 1983. At this meeting agreements were reached for expeditious handling of the above items among the several participants. With the cooperation of all participants, we anticipate that remedial action on a group of approximately 12 properties can be completed during 1983.

Question: Give us an update on the past accomplishments and planned activities in FY 1984 for the Salt Lake City site.

Answer: With regard to the remedial action at the processing site, or tailings pile, at Salt Lake City, we have published a Draft Environmental Impact Statement, known as DEIS, for public review and comment. Following the close of the comment period, we will begin discussions with the State of Utah and the Nuclear Regulatory Commission regarding the selection of the remedial action alternative to be pursued. These discussions will take into account the results of additional hydrological data which is currently being obtained. Once this basic decision has been reached, the NEPA process will be completed and the engineering of the remedial action will be initiated. Mobilization of the contractor onsite effort is currently scheduled to begin early in FY 1984, with site preparation work and excavation activities to follow later in the year.

Cleanup of vicinity properties at Salt Lake City began in the summer of 1981. Two properties were completed that year. Seven additional sites, including two commercial properties, were completed during the

1982 construction season. Plans are being made to cleanup six residential and seven commercial properties in FY 1983. In FY 1984 work on two major commercial properties and on some additional residential properties will be undertaken.

West Valley Demonstration Project

Question: Briefly provide the Committee with the current status of the West Valley Project.

Answer: Since occupying the site on February 24, 1982, the Project emphasis has been on readying existing facilities and systems for reuse, planning and conducting a presolidification decontamination program, and carrying out development and design activities associated with the waste solidification systems. We are currently establishing the project management and control systems and completing the technical scope of work and baseline cost and schedule estimate for conducting project activities through waste solidification. The systems and baseline plans for waste solidification and initial decontamination and decommissioning will be in place at the end of this fiscal year.

Question: For the record, please indicate how DOE plans to use the large increase in operating expenses in FY 1984? (Clearly identify the work to be performed and spending level.)

Answer: The breakdown of the FY 1984 request--budget authority--is as follows:

Waste solidifications	$15,700,000
Site operations	$10,000,000
Decontamination & Decommissioning	$ 4,300,000
Direct project support costs	$ 6,000,000

Briefly, during FY 1984 we will complete construction of the waste solidification component test stand which has the potential for conversion to radioactive operation; perform decontamination operations on major systems and areas for reuse, including equipment decontamination room, extraction chemical room, extraction cells 2 and 3, product purification cell, uranium product cell, analytical chemistry laboratory, and hot cell cranes, windows and manipulators; and design and procure handling equipment to process the large volumes of various liquid waste streams from the decontamination activities.

Three Mile Island (TMI) Cleanup

Question: With regard to the accident at Three Mile Island, what are the current estimates of total cleanup costs at TMI-2?

Answer: The current General Public Utilities Nuclear Corporation or GPUNC, estimate of the total cleanup costs at TMI-2 is $975 million. Of this total, $339 million was expended as of December, 1982.

Question: What is the current status of cleanup and what is the federal role?

Answer: The cleanup is proceeding at a reasonable pace. EPICOR-II and SDS liners are being shipped from TMI. Efforts are underway to remove the reactor head in the summer of 1983. The goal for initiation of reactor defueling is early 1985. The federal role is limited to those activities that are of general benefit or that relate to its unique responsibilities under the Atomic Energy Act of 1954 to ensure safe disposal of nuclear waste.

Question: On page 31 of the testimony you state that the federal role at TMI "is limited to research and development" and the cost of cleanup remains with the owner of the facility. In your view, do any of the DOE activities fall outside of the concept of generic R&D.

Answer: All of the DOE activities being conducted are considered generic R&D with the exception of some waste disposal activities. DOE has concluded a Memorandum of Understanding with the NRC--being provided for the Committee--which provides that DOE may assume responsibility for removal, storage, and disposal of solid wastes resulting from the cleanup if these wastes cannot be disposed of in commercial low level waste facilities.

Question: If so, who will pay these costs?

Answer: General Public Utilities will be required to reimburse DOE in these cases.

Question: Will these non R&D costs be paid for initially by the owner, the GPU Company, or will DOE be reimbursed later. Please provide the Committee with a copy of the agreement.

Answer: There is no general DOE/GPU agreement; reimbursement arrangements will be determined on a case-by-case basis. An agreement is being negotiated for GPU reimbursement to DOE for disposal of the reactor core. In addition, DOE may accept the EPICOR liners for reimbursible disposal. The current plan is for GPUNC to bury these liners in a commercial burial ground inside High Integrity Containers. If this is not possible, DOE will dispose of the liners and will be reimbursed by GPUNC.

Memorandum of Understanding
Between the
U.S. Nuclear Regulatory Commission
and the
U.S. Department of Energy
Concerning the Removal and Disposition of Solid Nuclear Wastes from Cleanup of the Three Mile Island Unit 2 Nuclear Plant

I. Objective

This memorandum of understanding specifies interagency procedures for the removal and disposition of nuclear wastes resulting from cleanup of the Three Mile Island Unit 2 plant. This will help to ensure that the TMI Site does not become a long-term waste disposal facility.

II. NRC Roles and Responsibilities

The NRC has the responsibility under the Atomic Energy Act of 1954 as amended (42 U.S.C. 2011 et seq.), to regulate all licensee activities at the TMI-2 site, including waste management, and ensure these activities are carried out in accordance with the requirements of applicable rules and regulations and the requirements of Facility Operating License Number DPR-73, as modified by amendments or orders issued by the NRC. NRC will carry out its responsibilities by onsite observation of licensee activities. As required, policy, and technical support will be provided to the NRC TMI Site Office by NRC Headquarters and Regional Office(s).

NRC will work cooperatively and closely with the DOE, and will keep DOE fully and currently informed of NRC's activities.

NRC will continue to keep public, state and local officials informed of NRC's activities. When appropriate, NRC will involve DOE in these information exchanges with the public, state and local officials.

III. DOE Role and Responsibilities

Where DOE determines that generically beneficial research, development and testing of the TMI-2 accident generated solid wastes can be carried out, DOE will perform such activities at appropriate DOE facilities. For those other wastes that cannot be disposed of in commercial low level waste facilities, DOE may also assume responsibility for removal, storage, and disposal to the extent that the licensee provides reimbursement to the DOE. These activities will be undertaken to the extent consistent with appropriate statutory authority. NRC licensing of DOE facilities that are utilized for storage, processing or disposal of TMI-2 accident generated wastes will not be required since these facilities have primary uses other than for receipt and storage of wastes resulting from licensed activities.

The DOE will provide technical support to the licensee and the NRC as deemed appropriate.

DOE will work closely with the NRC and keep NRC informed of DOE's activities.

IV. Currently Identified TMI-2 Accident Generated Solid Radioactive Wastes

The following lists those TMI-2 accident generated solid radioactive wastes which currently exist or are planned to be generated. This listing may be modified in the future as the cleanup progresses.

1. EPICOR-II System Wastes

Forty-nine ion exchange resin liners with loadings up to 1500 curies/liner are in temporary storage at the TMI-2 site. DOE plans to develop a prototype high integrity container (HIC), production units of which, if utilized by the licensee, may allow these liners to be acceptable for licensed disposal in commercial land burial facilities some 1-2 years from now. DOE is also performing characterization experiments on one of these liners and may find it desirable to extend its R&D program to other liners. Should a more expeditious handling of these wastes be required due to the potential for a limited release to the storage environment (which could cause public concern), a contingency plan will be implemented wherein DOE would at its discretion take receipt of these EPICOR liners on a reimbursable basis from the licensee for storage or disposal. Future EPICOR-II liners are anticipated to be loaded to allow commercial shallow land disposal offsite by the licensee.

2. Submerged Demineralizer System Wastes

It is anticipated that the dispersed radioactivity in accident generated water will be deposited on zeolites in submerged demineralizer system (SDS) liners. Due to the unique character and nature of these wastes, DOE will take possession of and retain these liners to conduct a waste immobilization research and development and testing program.

3. Reactor Fuel

Following removal of the damaged core from the reactor vessel, the entire core will be shipped to a DOE facility to survey and select those portions most appropriate for DOE's R&D program. Information obtained from detailed examinations is expected to be of generic benefit to design, fabrication and operation of reactor cores in a safe and efficient manner for current and future nuclear power plants. The remainder of the core will remain in storage at the DOE facility and will be ultimately disposed of under an agreement to be negotiated between DOE and the owner.

4. Transuranic Contaminated Waste Materials

As the cleanup progresses, some waste materials (e.g., sludges) may be found to be contaminated with transuranics at levels above which commercial low level burial facilities are authorized to accept. Alternatives for such material will be considered on a case-by-case basis and could include archiving, R&D evaluation or temporary storage onsite, or at a DOE facility awaiting further processing and/or disposal in a permanent repository offsite. Depending on the nature of these materials, DOE's activities could either take the form of an R&D program of generic value, or would be subject to reimbursement by the licensee.

5. Makeup and Purification System Resins and Filters

During the TMI-2 accident, the makeup and purification system demineralizer vessels and filters were highly contaminated by letdown of reactor coolant through the system. These resins and filters have not been characterized, however, based on radiation measurements, the resins and filters are believed to have specific activities well in excess of the loadings on the high specific activity EPICOR-II prefilters and are considered unsuitable for commercial land disposal. Due to the generic value of the information to be obtained and the very high specific activities of the filters, DOE will take possession and retain these filters for research and development activities. DOE will also take possession of and retain purification system resins either for an R&D program of generic value or for storage or disposal on a reimbursable basis.

6. Other Solid Radioactive Wastes

The low-level wastes associated with decontamination (e.g., some ion exchange media, booties, gloves, trash) will be disposed of by the licensee in licensed commercial low level burial facilities.

V. This Memorandum of Understanding will take effect when it has been signed by the authorized representative indicated below for each agency. DOE and NRC shall each have the right with the consent of the other party to modify this agreement.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Bernard J. Snyder
Bernard J. Snyder, Program Director
TMI Program Office
Office of Nuclear Reactor Regulations

Date: 3/15/82

FOR THE U.S. DEPARTMENT OF ENERGY

F E Coffman
Franklin E. Coffman
Deputy Assistant Secretary for
Nuclear Waste Management and
Fuel Cycle Programs
Office of Nuclear Energy
Date: 3/15/82

Uranium Enrichment

Question: On page 16 of your testimony, you indicate that the three gaseous diffusion plants will be operating at a power level of 3,190 megawatts. At what fraction of the total enrichment capacity is the installed plant currently operating and compare this to the proposed FY 84 level?

Answer: In FY 1983 the installed capacity of the three gaseous diffusion plants is about 27.3 million separative work units per year. The planned production in FY 1983 is 9.8 million separative work units or 36 percent of the installed capacity. The planned production in FY 1984 is 12.1 million separative work units or 44 percent of the installed capacity.

Question: What is the level of demand charges budgeted for FY 83 and FY 84?

Answer: In FY 1983, the demand or capacity charges for power not purchased were estimated to be $151 million. Of this total, $129 million would be paid to the Tennessee Valley Authority and $22 million to the Ohio Valley Electric Corporation.

In FY 1984, the estimated capacity charges for power not purchased are $243 million. Of this total, $226 million would be paid to the Tennessee Valley Authority and $17 million to the Ohio Valley Electric Corporation. Only the Tennessee Valley Authority capacity charges have been included in the FY 1984 budget estimate on the assumption that DOE will be granted relief from the Ohio Valley Electric Corporation capacity charges.

Question: If the gaseous diffusion plants were run in FY 84 at the same FY 83 level - what would be the level of capacity charges and the cascade power budget?

Answer: If the gaseous diffusion plants were operated at the FY 1983 power level, 2,660 megawatts, the FY 1984 cascade power budget would be $1,079 million and the total capacity charges for for power not purchased would be $288 million.

Question: Please explain the need for the increase in the FY 84 cascade power budget. Provide for the record, a breakdown of the increase including the amount for additional power, increases in the power cost, and increased capacity charges.

Answer: The FY 1984 power level represents a 530 megawatt increase over the FY 1983 level of 2,660 megawatts.

In January 1981, a technical study was begun by DOE's operating contractors to determine what the minimum acceptable risk power level should be based on the experience at the 2,660 megawatt level.

From this study, which was completed in June 1982, the contractors recommended the 3,190 megawatt level as the minimum acceptable risk power level. As a result of corrective actions taken, there are now fewer problems associated with normal cascade operations at the complex power level of 2,660 megawatts, but there are still important and valid concerns about process control under abnormal conditions. The impact of an incident at the 2,660 megawatt level would be far greater than at 3,160 megawatts in terms of personnel safety, environmental risks, and equipment damage. Increasing the power level to 3,190 megawatts increases the cascade UF_6 inventory which, when coupled with special low power operating procedures, results in greater process control and more acceptable operating risks under all conditions.

The FY 1984 cascade power budget represents an increase of $300 million over the FY 1983 estimate. The breakdown of the $300 million is as follows:

530 MW increase in power level	$167 million
Increased cost of power	58 million
Increased capacity charges for power not purchased	75 million
TOTAL	$300 million

Question: Discuss in detail the new enrichment contract, the Facility Requirements contract, which is being developed.

Answer: The Facility Requirements (FR) contract is in the final stages of drafting and should be available to customers in the near future. The FR contract is designed to be more flexible and more attractive to customers than the Adjustable, Fixed-Commitment (AFC) contract which was offered in 1978, with the intention of maintaining a more competitive position for DOE in both holding existing customers and attracting new business. The main features of the FR contract are:

- contract terms up to 30 years with two years of commitments (vs. five years in the AFC contract), firmed up on a rolling schedule

- short notice period (18-months) for committing to SWU's required in new second year

- customer may utilize inventories of previously distributed DOE SWU's, if available, to meet his requirements after giving appropriate notice.

Question: On page 12, you indicate a plan whereby "the most costly gaseous diffusion plants will be reduced, beginning in the early 1990's." Identify for the committee, these costlier facilities and your anticipated schedule for reductions.

Answer: Extensive cost studies are now in progress at the three gaseous diffusion plant sites. The results of these studies along with analysis of future power costs at the three sites will be used to develop a shutdown strategy for the gaseous diffusion plants. The most uneconomical facilities in terms of both operating and power costs would be the first one to be shutdown. We anticipate that the studies will be complete by the middle of this year. Actual shutdown dates have not been established at this time; however, based on the forecasted demand for enrichment services and the operational schedule for GCEP, shutdown of some gaseous diffusion facilities would begin in the early 1990's.

Question: Explain the 10-year program to improve efficiency of the gaseous diffusion plants. For the record, detail the total cost of the program, the amount spent to date, and the remaining amount for each activity.

Answer: The 10-year program to improve the efficiency of the gaseous diffusion plants is comprised of two individual construction programs. The Cascade Improvement Program (CIP) and the Cascade Uprating Program (CUP). Both programs result in additional capacity in the existing gaseous diffusion plants. These programs are accomplished concurrently, that is, when process equipment is removed from production modifications for both programs are accomplished before the equipment is reinstalled.

The CIP increases the efficiency of the existing process equipment by incorporating the latest gaseous diffusion technology. This includes installing new, improved barrier in the converters and modifying the process gas compressors and other process equipment to improve the aerodynamic efficiency. The CUP maintains the efficiency built in by the CIP and uprates equipment to efficiently utilize additional amounts of electrical power. This is accomplished by increasing the heat removal capability and making necessary modifications for higher pressure operation.

The current status of funding is shown on the following chart.

Funding Status
($-Millions)

	Total Authorized	Current Appropriations	Costs As Of 1/31/83
CIP*	$1,095.9	$1,067.9	$1,057.2
CUP	460.0	410.9	406.4

Final stage modifications will be completed during March 1983 after which only clean up work will remain.

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*Includes line item construction projects 71-1-e and 71-1-f.

Question: Last year, the Senate report directed DOE to submit to Congress a plan to operate the U.S. uranium enrichment program based on an assumption of no net outlays on an annual basis. What is the status of that report?

Answer: DOE is in the process of preparing a plan to operate the enrichment program on a basis of no net outlays on an annual basis. The FY 1985 budget requires DOE to address major programmatic decisions on GCEP and the AVLIS program. After resolution of these issues, DOE will complete it's plan and the results of this effort will be reported to the Committee in February 1984.

Gas Centrifuge Enrichment

Question: Mr. Voigt, please bring the committee up-to-date on the GCEP project - including the total expected cost, amount spent through FY 83, and request for FY 84.

Answer: The GCEP status is as follows:

GCEP STATUS

	(dollars in millions)		
	END FY 82	END FY 83	END FY 84
o Cumulative Project Appropriations	$1,540	$2,128	$2,700
o Cumulative Project Costs	1,198	1,812	2,413
o Engineering Status (2 Buildings)	86%	94%	100%
o Procurement Status (2 Buildings)	26%	41%	75%
o Construction Status (2 Buildings)	36%	60%	87%
o Budget Year Appropriation	588	588	572
o Budget Year Cost	444	600	602

o Project on schedule and within cost (TEC $7.45 billion for an eight building plant in FY 84 Dollars)

Question: Please describe the major activities of Phase I and Phase II of the project.

Answer: Phases I and II of the GCEP Project refer to the major procurement phases for procuring centrifuge machines. Phase I procurement started in late FY 1979 will be completed in FY 1984. The Phase I procurement will provide machines for testing in the Centrifuge Plant Demonstration Facility, and will provide enough machines to partially fill Process Building No. 1. Phase II procurement will be composed of two parts, IIa and IIb. Phase IIa will contract for enough centrifuge machines to complete filling Process Building No. 1 and to fill Process Building No. 2. Phase IIb will provide enough centrifuge to fill Process Buildings Nos. 3 through 8.

Question: Provide a breakdown of the FY 83 budget and FY 84 request in the major program areas of engineering, construction, procurement, and technical support for the total program for each process building.

Answer: The FY 1983 and FY 1984 budget breakdown for GCEP is as follows:

(dollars in millions)

	Appropriations FY 1983	Appropriations FY 1984
Engineering		
Recycle Assembly Building	$ 33	$ 28
Process Buildings	29	10
Feed and Withdrawal Building	16	30
Support Facilities	13	4
	91	72
Technical Support		
All Facilities	51	50
	51	50
Construction		
Recycle Assembly Building	37	30
Process Building No. 1	31	25
Process Building No. 2	24	46
Process Buildings No. 3 thru 8	0	0
Feed and Withdrawal Building	31	32
Support Buildings	50	28
Miscellaneous Construction	6	39
	179	200
Procurement		
Recycle Assembly Building	29	7
Process Building No. 1	172	156
Process Building No. 2	45	70
Process Buildings No. 3 thru 8	0	0
Feed and Withdrawal Building	12	10
Support Buildings	9	7
	267	250
Total	$588	$572

Question: List any funding requested in FY 84 for any activity, even design, planning or support which applies to the process buildings 3-8.

Answer: In FY 1984 there is no funding requested for any activity for Process Buildings 3 through 8 as they are duplicates of Process Buildings 1 and 2.

Question: With regard to Phase I, explain the reason for and the need to purchase from 3 manufacturers over 2,000 Set III baseline machines. How many baseline machines are under contract? Delivered? When do you plan to replace these machines?

Answer: Over 2,000 Set III centrifuge machines are needed to partially fill Process Building 1 and to have the first train (one-eighth of a Process Building) operational at GCEP by the end of FY 1985. The balance of the Set III centrifuges, enough to fill Process Buildings 1 and 2, will be fabricated sequentially in increasing quantities by the centrifuge manufacturers starting the last quarter of FY 1984. The Set III machines will be replaced when Set IV or Set V machines are production qualified.

The exact quantity of Set III machines needed for Process Buildings 1 and 2 is classified information and, if desired, can be provided under separate, protective cover.

Question: Please provide a list of the number of Set III, IV and V machines which will be procured and when and where they will be installed.

Answer: Enough Set III machines will be manufactured to fill Process Buildings 1 and 2 starting in FY 1984 and continuing through FY 1989. The timing for retrofitting of Sets IV and/or V in Process Buildings 1 and 2 will be a function of the availability and the lifetime of Set III and/or the proven economics of Sets IV and V machines. Exact numbers of machines are classified and, if desired, can be provided under separate, protective cover.

Question: Provide a listing of the dates for development, testing, procurement, and operation of the centrifuge machines - Set III, IV, and V.

Answer: The Set III gas centrifuge has been qualified for use in the Gas Centrifuge Enrichment Plant (GCEP). Reliability testing has been under way in the Advanced Equipment Test Facility since May 1981 and will continue at least through the end of FY 1983. Operations testing has been under way in the Centrifuge Plant Demonstration Facility (CPDF) since August 1982. The CPDF is a multi-centrifuge cascade like the one that will operate in GCEP. Procurement of an initial supply of Set III gas centrifuges was initiated in September 1979. Procurement of an additional supply will be initiated in February 1984. Operation of the first train of Set III gas centrifuges in Process Building No. 1 of GCEP, using uranium hexafluoride process gas, is scheduled to begin during July 1985.

The Set IV gas centrifuge is presently in the developmental phase. Set IV builds upon and expands the technology developed for Set III. The Set IV gas centrifuge is intended to substitute for Set III centrifuges in GCEP without a need for facility modifications. Features of the Set IV concept are currently under technical evaluation in full-scale gas centrifuges. From these tests, DOE will determine by late 1983 what the optimum Set IV design should be to attain desired performance. Reliability testing of Set IV gas centrifuges will be initiated in the Advanced Centrifuge Test Facility in mid-FY 1985. Procurement of standard Set IV production centrifuges would begin in mid-FY 1986. The first Set IV gas centrifuges are scheduled for installation in Process Building No. 3 of GCEP in early FY 1989.

The Set V Gas Centrifuge Program is a recently expanded study of a new gas centrifuge concept. The materials assessment that was funded in FY 1981 and FY 1982 was accelerated beginning in January 1983. At this early state of the Set V development, schedules for testing, procurement, and operation cannot be affirmed with any degree of confidence. We believe it will be possible to specify the design features for the Set V gas centrifuge by early FY 1986. The engineering/demonstration phase is expected to consume from 4 to 6 years, leading to start of reliability testing in 1989. On this tentative schedule, the start of production of Set V gas centrifuges could be in 1991, for installation in Process Building No. 4 and subsequent buildings of GCEP.

Question: Please discuss your efforts to accelerate the Advanced Gas Centrifuge Program and the projected benefits.

Answer: The Advanced Gas Centrifuge Program consists of research and development on high performance gas centrifuges, designated Set V. Accelerated development of high performance gas centrifuge technology is embodied in the Set V Program. Development of Set V was originally planned to begin in about 1984. However, the excellent results attained in Set III and IV machines, and the availability of improved materials, indicated the wisdom of accelerating the development of the Set V machine. As described in the answer to the previous question, this is expected to lead to availability of Set V gas centrifuges for installation in Process Building No. 4 of GCEP in 1991.

The Set V gas centrifuge is expected to have a separative capacity that is 2 to 3 times greater than the baseline Set III design. It is too early to project with accuracy what the Set V gas centrifuge will cost. However, if one assumes a cost comparable to Sets III and IV, then the substantial improvement in separative capacity would result in a corresponding substantial reduction in the cost of separative work for enriched uranium compared with the existing GCEP expectations. At this stage of development, we estimate the cost of enrichment services from Set V will be in the same competitive range as the costs being projected from AVLIS.

"ADDITIONAL COMMITTEE QUESTIONS"

Question: When were the Phase I contracts signed and what is the duration of the contracts?

Answer: The Phase I contracts for manufacture of centrifuge machine components were signed in September 1979 for completion in September 1984.

Question: What are the production and procurement schedules from the 3 manufacturers for the Set III machines in Phase I? Please be specific and include a list of dates, amount of federal funds needed for procurement and the number of machines produced and procured in each fiscal year.

Answer: Centrifuge machines are being fabricated as component assemblies/subassemblies by the centrifuge manufacturers (CMs) for subsequent shipment, assembly and installation at the Gas Centrifuge Enrichment Plant (GCEP). The average quantity of Set III machine components to be made by each of the these CMs under the Phase I contracts is enough to fill 1/8 of Process Building 1. In addition, components were manufactured between September 1981 and June 1982 for use in the Centrifuge Plant Demonstration Facility (CPDF) for reliability and other verification testing. In total, Phase I procurement provided machine components for CPDF and for approximately 3/8 of Process Building 1.

The balance of the machine components are now in the current final manufacturing cycle of Phase I which will be completed in September 1984. These machine components will be shipped to the GCEP site and assembled into complete machines in the Recycle/ Assembly Building and installed in Process Building 1.

The production rate of machine components for GCEP and the annual obligations to the CMs are as follows:

	Fiscal Year	Number of Machines*	Obligations in Millions
Cumulative thru	82	0	160
	83	3/16	55 to 60
	84	3/16	70 to 80

GCEP obligations shown above are for purchase of centrifuge machines to fill 3/8 of Process Building 1. Additional components and spare parts will also be purchased under the Phase I contract.

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* For security reasons, shown as the approximate fraction of a process building. The restricted numbers will be provided under separate cover.

Question: When is Phase II expected to begin and describe the activities included in this phase?

Answer: Present planning is for Phase II centrifuge machine procurements to start in October 1984. The activities are divided into two segments. Phase IIa calls for the CMs to fabricate enough machine components to fill the balance of Process Building 1 and all of Process Building 2 with Set III gas centrifuges. Phase IIb addresses the filling of GCEP Process Buildings 3 through 8.

Question: When will the contracts for Phase II be developed and signed by the manufacturers?

Answer: The contracts for Phase IIa are now under development. It is planned that they will be negotiated and signed in February 1984.

Question: How many Set III machines will be procured under Phase II?

Answer: Set III machine components will be procured under Phase IIa to complete filling Process Building 1 and completely fill Process Building 2. The number of centrifuge machines required is restricted and will be provided under separate cover.

Question: What is the schedule for procurement and production from the 3 manufacturers for the Set III machines in Phase II or for the first 2 process buildings? Please be specific and list the number of machines produced and the amount of federal funding needed for procurement in each fiscal year.

Answer: The schedule for Phase IIa production is as follows:

Fiscal Year	Number of Machines*	Estimated Obligations in Millions
84	0	$ 50 to 90
85	3/16	100 to 150
86	5/16	125 to 175
87	8/16	130 to 180
88	9/16	140 to 160
89	1/16	0

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* For security reasons, shown as the approximate fraction of a process building. The restricted numbers will be provided under separate cover.

GCEP obligations shown above are in FY 1984 dollars and are the range estimated for purchase of centrifuge machines for 1 and 5/8 Process Buildings. Additional components and spare parts will also be purchased under the Phase IIa procurement.

Question: Please list the expected delivery schedule for all Set III machines under the current contracts and departmental plans.

Answer: The delivery schedule for machine components is essentially the same as the production schedule described in the answer to the previous question. Machine components will be sent to the Recycle/Assembly Building at GCEP where production and inspection are completed for assembly.

Question: How many Set III machines are needed to fill Process Building 1? How many for Process Building 2?

Answer: Process Buildings 1 and 2 each require several thousand centrifuge machines. For security reasons, the exact number of machines will be provided under separate cover.

Question: How much is being spent in the FY 84 request for Set IV and Set V machines? Describe the work to be accomplished.

Answer: The FY 1984 budget request includes about $33,000,000 capital funding in the GCEP project for detailed Set IV design and procurement of Set IV reliability test machines. An additional $29,800,000 is requested for the base Set IV development program and operation of existing test facilities. The budget also includes $14,700,000 for development work and facility operations associated with the Set V centrifuge machine.

During FY 1984, we anticipate a Set IV machine will operate in test close to or at the baseline design capacity of 50 percent higher than Set III machines. In FY 1984 the Set IV centrifuge will continue prototype testing and design finalization. This testing will establish the reliability (durability) of the centrifuge under long-term routine plant operation. The prototype units will serve as reference machines with which screening units in other test facilities can be compared. At the subassembly level, testing will continue to verify and characterize the subassembly designs, principally at the centrifuge manufacturers, and to optimize, or fine-tune, the subassemblies to provide optimum performance of the prototype and reliability units. Component development will also continue to improve the cost effectiveness on a subassembly basis.

Development of the Set V centrifuge concept was accelerated in January 1983, based in large measure on outstanding success in gas centrifuge technology. The expanded development effort springs from a study of alternate materials and operational concepts conducted in FY 1981 and FY 1982. It focuses on the fabrication and testing of gas centrifuge rotors and suspension systems to provide complete centrifuges necessary for spin-testing. A full size Set V centrifuge will be operating this summer.

Question: Under the current departmental plan, when do you expect Set IV and Set V machines to be production qualified?

Answer: The target production design qualification date for Set IV is the 2nd quarter of FY 1986. The similar qualification date for Set V is 2nd quarter of FY 1989. Accomplishment of the design qualification tests is a prerequisite for full production release of the centrifuge to the manufacturers. Studies are underway to accelerate the Set V qualification date.

Advanced Isotope Separation

Question: Do you believe the AIS process has the potential to reduce substantially the costs of enrichment below the other technologies?

Answer: Construction and operating costs for AVLIS production tion deployment in the early 1990's are projected to be below gaseous diffusion and gas centrifuge using either Set III or Set IV. The uncertainties surrounding both the AVLIS and Set V centrifuge technologies is such that we cannot at this time state which technology will produce the lowest cost enrichment services.

Question: Explain your efforts in FY 83 and FY 84 to accelerate the development of the AIS technology.

Answer: The AIS strategy as contained in the DOE budget request was to continue and complete key experimental data packages and begin design of a Development Demonstration Module (DDM). The strategy called for use of the Special Isotope Separation Laboratory (SISL) to demonstrate process physics. The DDM was scheduled for operation in FY 1988 or 1989, allowing a decision regarding production deployment from AIS in 1990.

DOE has agreed to proceed with a revised strategy as proposed by Lawrence Livermore National Laboratory (LLNL) and Union Carbide Corporation - Nuclear Division. Under the revised strategy, the DDM will not be built. Instead, we will expand the functions of the SISL to include the most important engineering design features from the DDM. The SISL demonstration is equivalent to about 75 percent of the equivalent technical demonstration that would have been done in the DDM. The revised strategy will save $300 million through 1990 and accelerate the decision date on the process by 3 years to 1987.

Uranium Enrichment Market

Question: The market for enriched uranium is largely determined by the number of nuclear power plants now in use or planned for the future. What is the current forecast of domestic and foreign nuclear generating capacity in terms of gigawatts and power plants through the year 2000?

Answer: The following table shows the cumulative August 1982, most likely projections of U.S. and non-U.S. nuclear power plants and their corresponding electrical generating capacity through the year 2000 that is expected to receive enrichment services from DOE.

End of Year	U.S. Number of Plants	U.S. GWe	Non-U.S. Number of Plants	Non-U.S. GWe
1983	84	69	61	42
1984	94	80	62	44
1985	101	87	66	48
1986	108	95	68	50
1987	118	106	74	55
1988	123	111	78	59
1989	126	114	80	61
1990	129	119	77	59
1991	130	120	77	59
1992	131	121	83	65
1993	132	122	90	72
1994	132	122	95	76
1995	133	123	100	81
1996	134	125	108	89
1997	135	127	105	87
1998	137	129	98	83
1999	139	131	100	85
2000	140	133	102	87

Question: How has this forecast changed over the last 5 years?

Answer: The following table compares DOE's August 1982, most likely civilian nuclear power growth forecast for which enrichment services will be supplied by DOE to a forecast made in June 1978.

Cumulative Civilian Nuclear Power Gigawatt Growth

End of Year	Current U.S.	Current Non-U.S.	Current Total	June 1978* U.S.	June 1978* Non-U.S.	June 1978* Total
1983	69	42	111	90	53	143
1984	80	44	124	105	58	163
1985	87	48	135	115	65	180
1986	95	50	145	129	72	201
1987	106	55	161	143	79	222
1988	111	59	170	157	86	243
1989	114	61	175	171	93	264
1990	119	59	178	185	100	285
1991	120	59	179	199	107	306
1992	121	65	186	213	113	326
1993	122	72	194	217	118	335
1994	122	76	198	217	118	335
1995	123	81	204	217	118	335

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*Forecast was made only through 1995. DOE would supply on a sustaining basis 335 GWe of nuclear power capacity.

Question: How much of the foreign enrichment market are we supplying and how does this compare to each of the last 5 years?

Answer: The following table shows our current projection of the percentage of the foreign enrichment market we are supplying, and the corresponding percentages for each of the last 5 years.

Percent of foreign enrichment market supplied by DOE:

Year	1978	1979	1980	1981	1982	1983
Percent	68	59	36	34	36	39*

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*EURODIF has recently agreed to reduce deliveries to Italy and Spain, reducing the EURODIF share of the foreign market which also means increasing the U.S. share to 39 percent, which is higher than reported in DOE budget testimony.

Question: Please list our foreign enrichment competitors, the process used by each and their current and planned capacity.

Answer: A list of our foreign enrichment competitors, the process used by each, and their current and planned capacity is as follows:

Competitor	Process Used	Capacity, Million SWU/Year Current	Planned
Eurodif	Gaseous Diffusion	10.8	10.8
Urenco	Gas Centrifuge	1.0	2.0 by 1990
USSR	Gaseous Diffusion	3 (for export)	3 (for export)

Question: Is there any potential for losing a portion of the domestic market?

Answer: Yes. During 1982, for the first time, a domestic utility (South Carolina Electric and Gas) terminated its contract with the U.S. in favor of a foreign supplier, i.e., Eurodif. In addition, a great number of direct U.S. sales are being replaced by secondary market transactions. Though sales replacement by excess enrichment commitments originally produced by DOE is understandable, secondary market transaction of non-U.S. enriched material for use as a replacement for U.S. sales is occurring more frequently.

As of March 1983, three U.S. utilities (Florida Power and Light, Commonwealth Edison and Wisconsin Public Service Company) have terminated enrichment services from DOE in FY 1983 alone (valued at more than $100 million) and committed to purchase heavily discounted excess foreign-origin enrichment material.

Question: Please comment on the prospects for maintaining or even increasing our foreign and domestic share.

Answer: The prospects for the U.S. to maintain or even increase its foreign and domestic share of the market will depend primarily upon our ability to offer enrichment services at attractive price levels. Price has become the most important sales consideration to enrichment customers. Competitive pressures from foreign suppliers who are offering price guarantees at levels below the U.S. price and large secondary market quantities have created market instabilities and significant sales uncertainties for the U.S. enrichment business. We are faced with the need to compete in a highly unstable, low price enrichment market.

We are taking a number of actions to enhance the market position of the U.S. Production costs are being reduced and enrichment production activities are being optimized. A new enrichment contract is being developed to provide needed stability between utility commitments and requirements by offering greater contract flexibility. Finally, we are developing advanced, low cost technologies and deploying them on a schedule designed to provide the lowest prices in the world from U.S. enrichment facilities. We believe these steps will greatly enhance our ability to maintain and eventually expand the U.S. share of the foreign and domestic markets.

Question: Briefly comment on the reasons the U.S. has lost a portion of the world enrichment market.

Answer: DOE has experienced a decline in its share of the foreign enrichment market due to: the emergence of foreign enrichment competition (actual deliveries from Urenco and Eurodif as well as from the USSR); the desire of foreign customers not to be dependent on a single supplier of enrichment services; the perceived uncertainties in their ability to obtain an export license for enriched uranium; the image of the U.S. as an unreliable supplier as a result of the Nuclear Non-Proliferation Act of 1978; and, recently, the offering of competitor prices below those DOE must charge.

MONITORED RETRIEVABLE STORAGE

Senator JOHNSTON. Thank you, Mr. Chairman.

Dr. Brewer, I am very pleased to hear that you are going to comply with the Nuclear Waste Act on the monitored retrievable storage.

Would you tell me what you consider your duty to be under the law by June 1, 1985?

Mr. BREWER. I would like Mr. Morgan to respond. He is the Project Director, reporting to the Secretary, on implementing the Nuclear Waste Policy Act of 1982.

Mr. MORGAN. Senator Johnston, it is quite clear that we have to submit a proposal for construction of one preferred site concept and four alternatives with an environmental assessment and program for siting and development and construction operations and integrated planning.

We intend to submit that and we will have the appropriate engineering support and design activities to provide a new cost estimate at that time, sir.

Senator JOHNSTON. You say a program with engineering support. What specifically is that engineering support?

Mr. MORGAN. The engineering design activities; in other words, to do the appropriate design rather than to take it into the study. We have studied it for quite some time. Now we intend to do some title I design activities to get a cost estimate out of the $12 million that we are recommending in the 1984 budget; $7 million of that will be for engineering design, sir.

Senator JOHNSTON. Design on which firm cost estimate will be based?

Mr. MORGAN. Design in order to design the facilities so that you will have a good cost estimate, as required by law. That money will be utilized to comply with the requirements of the design activity.

Senator JOHNSTON. Do you understand that the law requires you to have it sufficiently designed to go to bids in the field?

Mr. MORGAN. Yes.

DESIGN COST

Senator JOHNSTON. Do you think you can do that with $12 million?

Mr. MORGAN. We believe with that and some additional—we will have some money available in the 1985 budget also and we would intend to comply with the law and we are looking at the number of requirements in 1985, sir.

Senator JOHNSTON. What do you see as a total cost of design here?

Mr. MORGAN. We are looking at a total cost for 1983–1985 and something like $25 million.

Senator JOHNSTON. That is based upon what?

Mr. MORGAN. Sir?

Senator JOHNSTON. What is that estimate based on?

Mr. MORGAN. What we believe are the needs in the design activities so that we can comply with the statutory requirements for the proposal in June 1985.

Senator JOHNSTON. Have you talked to any experts or have you done it all in-house?

Mr. MORGAN. This is in-house now. That is why we are going to submit that after consultation, but we intend to submit that number to OMB within 30 days, sir.

Senator JOHNSTON. Do you have any kind of critical path worked out for the MRS?

Mr. MORGAN. Not at this time, sir.

Senator JOHNSTON. What do you plan to do? Somebody has reached out and found $12 million and put it in the budget. That is better than the zero it was before when we had our hearings. But I am anxious to know what steps you will take. I mean, for example, you are having hearings on the deep geologic around the country. This is supposed to be on a parallel track. I haven't heard any plans for hearings on monitored retrievable storage. Have you thought through what those steps are going to be?

Mr. MORGAN. We believe that in the interpretation of the act that we would be required to do the same processes and the same steps regarding MRS as we do in the geologic repositories and we are putting that together right now, sir. We would have that critical path within 30 days, sir.

Senator JOHNSTON. You will have a critical path?

Mr. MORGAN. Yes, when we come in with our budget recommendations.

Senator JOHNSTON. What consideration have you given to the hiring of firms?

Mr. MORGAN. May I defer the question to Mr. Lawrence?

Mr. LAWRENCE. Senator, for the balance of this year we intend to complete the R&D study which is required by the act, identify what is necessary, narrow down the concepts and the site selection process for the MRS so that in fiscal year 1984 we will hire a major support contractor, go out on bid for that, and receive basically the $7 million which Mr. Morgan mentioned, then contract to do the detailed conceptual design, title I design, and site work necessary for the proposal in fiscal year 1985.

It will be a fiscal year 1984 activity.

Senator JOHNSTON. You plan to do the site selection in-house?

Mr. LAWRENCE. The monitored retrieval storage facility is engineered and, to a degree, is independent of the site. It can be engineered around. The act does require us to take such things as transportation and proximity to existing reactors and waste sites into consideration. We have already done some of that work through our contractors in previous years on previous MRS studies. With that information, we do have some indication of the general vicinity where sites are going to be done.

We are going to hone that down this year so that as soon as potential sites are identified, those States will be notified and we will go through the hearing process.

DESIGN ALTERNATIVES

Senator JOHNSTON. I am not an expert on design, but I know there are a number of alternative designs. Some would be in the mountainside, sort of tunnels in the mountain. Others would be more generic design that can be put anywhere; others are designed using casks put in the sand and which would be peculiar to the desert. I am wondering whether you don't feel it is necessary at this point prior to the time you narrow down your kind of design that you have to get the experts involved. Is there anyone in-house there that is an expert on MRS?

Mr. LAWRENCE. We do have contractors that are expert, but we have already gone out and hired outside contractors who have worked in this previously. The General Atomics Co., Boeing, Rockwell, and Westinghouse have all been involved in previous activities on MRS in 1981 and 1982. As you know, the studies which we have done previously have looked at certain concepts. Basically, the results so far from those indicate that dry wells, casks, vault-type storage are preferential and can be engineered around, somewhat independent of the actual site. So those contractors that worked on those specific designs are working now with our lead contractor at Richland.

Senator JOHNSTON. Dry well is what?

Mr. LAWRENCE. That is a sleeve in the ground that is shallow, about 14 feet down, a mettle sleeve, backfill around it. That can be engineered around if you have an unfavorable location by building a berm and sinking the dry well into a berm-type of arrangement.

Senator Johnston. I had thought that that was not preferential, that the more preferential was a longer tunnel-type situation further underground?

Mr. Lawrence. Sir, the study that was done in 1981 which DOE, Edison Electric Institute, and Tennessee Valley Authority did looked at the tunnel rack concept and the dry well concept. Both were found to be feasible and doable. The results of that study, however, preferred the dry well concept. That is not to say tunnel rack will not be considered.

Senator Johnston. You say the results of the study did prefer the dry well?

Mr. Lawrence. Yes, it did.

Senator Johnston. Mainly because of cost?

Mr. Lawrence. It was considered to be cheaper; yes, sir. But either one could be done. There were no technological barriers to either concept. Last year, in 1982, in addition to looking at the dry well, the cask concept, which is similar to what the utilities will be using to increase their at-reactor storage, was also looked into to see how that would fit into a system of the reactor storage and repository. That will be factored in. The act requires us to look at the integration study. If you do have reactor storage at a site and you eventually go to the repository, the interaction with the cask with an MRS is something which we are considering.

Senator Johnston. This dry well, 7 feet underground, I know it would be technologically very satisfactory. As I understand you need only about 4 feet of earth to shield against any of your neutrons or gamma rays. Part of our problem here is public perception. It would seem to me that the public perception of just having some dry wells under 7 feet of earth is not going to seem as safe as if it were in a tunnel in the mountain. I would simply throw that out to be considered.

Are you handling the State participation in a way that is parallel to the geologic program?

Mr. Morgan. We will handle it exactly in a parallel basis going through the site selection activities, as we have done in the repository, sir.

IMPORTANCE OF MRS

Senator Johnston. Let me say, Mr. Morgan, the Energy and Natural Resources Committee has been working on this problem for about 10 years, working on it with real dedication for 4 or 5 years; passed legislation in the Senate twice and then the act finally in this last Congress. We have become convinced, at least the vast majority of us on that committee, that it is going to be very difficult to get deep geologic storage at least with any kind of time constraint specified in the act. That is true, not because of the technological difficulties but because of first the legal difficulties, the charge you will have is to design a deep geologic storage facility which you can prove will be impervious to any assault from water or outside elements, virtually forever, 10,000 years, whatever it is.

That is almost impossible to prove.

It has been impossible to prove over these years. Ten years ago they said the solution is just around the corner, and the solution is still as far away. It is like the commercialization of shale. You know, it is almost within the price range now and every year that goes by it keeps getting a little more expensive. I do not wish it, but I fear that that is what is going to happen with geologic disposal. That is why we think it is so important to go with the MRS which I believe has technological advantages. The waste can be monitored, it can be retrieved, and more than that you are dealing with waste which needs to cool down before you put it in some geologic medium.

When you have that much heat to put in, whether it is granite or whatever, it may crack the granite or the basalt, it may melt the basalt or whatever. That is why the European countries that I know about have all gone to MRS. They haven't abjured forever going to deep geologic, but they say we will think about that in 50 years. In the meantime, this is perfectly proper. So I hope that you will go at this problem to solve it. Up to this point it hasn't had, as you know—maybe you didn't get the word as to what the legislation required, but it was obviously not going to be solved. With $3.5 million in 1983, and zero in fiscal year 1984, there was just no way it is going to happen.

I don't know if it was overlooked or if it is not important what has gone on in the past. It is important what you do in the future. It doesn't look to me like the program is sufficient. There is no supplemental for fiscal year 1983. You need more than that—as you can't let a whole year go by with justified look-around money, $3.5 million and then expect $12 million to design a facility or alternate facilities in 1984 to meet this deadline. I think you have got to do a lot more. I think that that Office must be put in real high gear. I think you have to get some experts.

You have been talking to them but over 2 months has gone by now without much progress. So I would simply urge that if you are going to get a parallel track, there has got to be a lot of catching up to do and it is going to be difficult to meet that deadline. I would hope you can.

Mr. MORGAN. Mr. Johnston, I want to assure you that we do consider it a parallel program and the commitment from the Secretary is to meet the requirements of the law and we fully intend to do that, sir.

Senator JOHNSTON. Let me suggest one final thing. I am intruding on the time of the chairman a great deal. But one of the best witnesses, perhaps the best witness we have had through the years, was a Dr. Hammond. I hope you will talk to Dr. Hammond. The staff will have his address. I know he did some designs.

Mr. MORGAN. Yes, sir, we will do that.

Senator JOHNSTON. Thank you, Mr. Chairman.

Chairman HATFIELD. Thank you, Senator Johnston.

Thank you, gentlemen. You made a very excellent statement here today. I appreciate your being here.

SUBCOMMITTEE RECESS

The committee will now stand in recess until Thursday at 2 p.m. when we will have Assistant Secretary Trible on solar programs.

[Whereupon, at 2:50 p.m. Tuesday, March 1, the subcommittee was recessed to reconvene at 2 p.m. Thursday, March 3.]

ENERGY AND WATER DEVELOPMENT APPROPRIATIONS FOR FISCAL YEAR 1984

THURSDAY, MARCH 3, 1983

U.S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Washington, D.C.

The subcommittee met at 2:09 p.m. in room SD-192, Dirksen Senate Office Building, Hon. Mark O. Hatfield (chairman) presiding.

Present: Senator Hatfield.

DEPARTMENT OF ENERGY

SOLAR, CONSERVATION, AND RENEWABLE ENERGY PROGRAMS

STATEMENT OF JOSEPH J. TRIBBLE, ASSISTANT SECRETARY FOR CONSERVATION AND RENEWABLE ENERGY

ACCOMPANIED BY ROBERT L. SAN MARTIN, DEPUTY ASSISTANT SECRETARY FOR RENEWABLE ENERGY

INTRODUCTION OF WITNESSES

Chairman **HATFIELD**. The hearing will come to order.

Today, we continue our hearings on the Department of Energy budget request for 1984.

The purpose of this hearing is to receive testimony from the Department's so-called renewable energy programs within the subcommittee's jurisdiction.

As our principal witness today, we welcome Joseph J. Tribble, the Assistant Secretary of Conservation and Renewable Energy. We look forward to hearing from you, Mr. Secretary.

If you will introduce your colleague, we will proceed to put your testimony in the record, your full testimony, as if given, and you may proceed to summarize or highlight it.

Mr. **TRIBBLE**. Thank you, Mr. Chairman.

With me today is Dr. Robert San Martin, who is Deputy Assistant Secretary for Renewable Energy.

We are pleased to be here to discuss with you the programs under the jurisdiction of this subcommittee which are our responsibility.

STATEMENT SUMMARY

I will, if I may, go forward as you suggest, just with a brief summary of general comments, rather than an attempt to summarize the testimony that has been presented.

During the past 10 years, numerous technical achievements in innovative energy technologies have contributed to the emergence of a renewable energy industry.

Early this week, I had the opportunity to attend a portion of the energy technology conference that was being held in Washington and to see the exhibits in the exhibit hall. Many of the papers presented discussed research being done by the private sector in the renewable energy industry.

Many of the exhibits displayed hardware accomplishments which had been achieved. Unquestionably, much of the progress that has been made has stemmed from work that has been funded through the Department of Energy, and it is encouraging to see that the private sector is using and building upon this knowledge base.

Additional research is still necessary, and in structuring the programs which we are presenting for your review, we have made an effort to identify research which the private sector is not likely to undertake, but which, if done, would be in the national interest.

Our goal is to enlarge the knowledge base for all these technologies and to fill the gaps where research is needed.

All of us are familiar with the current oil situation. I doubt if any of us feel that the relative oversupply will be long lasting. We do not feel that the current so-called oil glut is a reason for us to relax our efforts to further develop renewable energy technologies.

Generally, a number of years are required between research efforts and the implementation of the results of that research on a wide scale. We are satisfied that the research that we are proposing to be funded will be quite valuable in permitting renewable energy sources to help meet the demand when the price of petroleum again begins to escalate.

In most instances where the fiscal 1984 request is below that appropriated for fiscal 1983, it reflects a further redirection of the program away from costly demonstration projects and toward research.

Mr. Chairman, this concludes my introductory remarks. We would be pleased to answer any question—or attempt to—posed on the subcommittee's behalf.

[The statement follows:]

STATEMENT OF JOSEPH J. TRIBBLE, ASSISTANT SECRETARY FOR CONSERVATION AND RENEWABLE ENERGY

Chairman and Members of the Subcommittee:

I appreciate this opportunity to appear before you today to discuss the Department of Energy's FY 1984 budget request for Renewable Energy, Electric Energy Systems, and Energy Storage programs under the jurisdiction of this Subcommittee. All of these programs report to the Assistant Secretary for Conservation and Renewable Energy for programmatic direction.

By way of overview, the FY 1984 Energy Supply Research and Development budget request for the programs subject to today's hearing total $129.2 million. The accompanying table provides a summary of funding allocations by program area.

For budgetary purposes, a number of program elements have been combined. Accordingly, R&D components of the historical Alcohol Fuels, Biomass and Energy from Municipal Waste programs are discussed within the FY 1984 context as an integrated Biomass R&D program. Similarly, components of the historical Active, Passive and Solar Thermal program are integrated into the Solar Heat Technologies program.

INTRODUCTION

During the past ten years, numerous technical achievements in innovative energy technologies have contributed to the emergence of a renewable energy industry. Research is still necessary, however, to expand the technology base so that industry can continue to develop and apply these concepts with its own investment capital. The Federal role in this context is to sponsor long-range, high-risk, high payoff energy research which industry cannot reasonably be expected to exclusively support; and to develop fundamental scientific and engineering knowledge which can provide the basis for new energy developments and the opportunity for increased use of renewable energy.

The budget request submitted to the Subcommittee today represents a continuing commitment to research and development for each technology. These funding proposals were carefully reviewed to ensure that activities to be funded are consistent with the Federal R&D role. In formulating this request, the Department considered a number of inputs including sources such as the Energy Research Advisory Board (ERAB), Congressional hearings, and informal discussions with industry representatives.

FY 1984
RENEWABLE AND SELECTED ENERGY CONSERVATION PROGRAMS
($ In 000's)

	FY 1984 Requested Budget
Solar Energy	
Solar Heat Technologies	21950 A/
Photovoltaics	32700
Biomass	17300 B/
Wind	8600
Solar Technology Transfer	3100
Solar Program Direction	3009
Total Solar Energy	86659
Geothermal	
Geothermal Technical Development	
Hot Dry Rock	5040
Hydrothermal Research	4434
Hard Rock Penetration	2640
Magma Energy	845
Technology Transfer	100
	13059
Hydrothermal Industrialization	0
Geothermal Program Direction	494
Total Geothermal Energy	13553
Total Renewable Energy R&D	100212
Energy Storage	14200
Electric Energy Systems	12702
Geothermal Resources Development Fund	2100
TOTAL CONSERVATION AND RENEWABLE ENERGY R&D FUNDED FROM ENERGY AND WATER DEVELOPMENT APPROPRIATION	129214

A/ For FY 1984 Active, Passive and Solar Thermal research activities are combined into the new Solar Heat Technologies program element.

B/ The FY 1984 proposed Biomass program consists of a combination of the former separate Biomass, Alcohol Fuels and Urban Waste Program elements.

Four general criteria were used to guide the selection of activities included in this request. First, it should be consistent with the Federal emphasis on long-term, high-risk energy research. Second, the research should add measurably to the technology base. Third, the activity should not duplicate work being performed by the private sector. Finally, the activity should have a high-payoff potential.

This careful scrutiny and selection of priority activities has resulted in a sound budget strategy for these energy R&D programs and we are encouraged by the potential they show for establishing a solid technology base. I would now like to provide for you an overview of the various programs included in the budget request.

SOLAR HEAT

The Solar Heat Technologies program supports R&D activities to provide a sound technology base which advances the development of thermal materials and to provide a better understanding of thermal sciences.

Previous R&D efforts have provided significant achievements to date. It is now possible, for example, to convert solar energy to useful thermal energy at temperatures from near ambient to more than 2500°F. Experiments with new collector glazing techniques; research on advanced materials; and identification of new technologies to light building interiors show promising cost and performance results. In cooperation with utility partners and the State of California, the Barstow Central Receiver Pilot Plant was completed. This facility is the world's largest solar electric generating plant.

During FY 1983, research is being conducted on high temperature materials and concentrators which can significantly improve the performance and reliability of high temperature collectors and receivers. Research will be performed for second generation heliostats, and high temperature storage components. System studies and conceptual designs will be undertaken to determine the feasibility of central receiver thermochemical hydrogen production. The program will also develop, fabricate and test an advanced dish concentrator for generic thermal electric application. In addition, various coating materials will be tested for increased reflectivity and collector surface life. The intent of this activity is to ultimately discover glazings which will improve the insulation value of windows and allow solar or thermal radiation control.

The Solar Heat Technology program request in FY 1984 totals $21.95 million. This request includes $11.75 million for Materials Research, $7.2 million for Central Receiver Technology, and $3.0 million for Heat Transfer Systems Analysis.

In Materials Research, activities will include test and evaluations of materials with improved thermal tolerances, optical properties and heat transfer characteristics. Thermal-related research will involve the testing of materials to determine their ability to withstand the high temperature and thermal cycling encountered in electric power applications and fuel or chemical production. Research will be conducted to develop new low cost, high performance polymer and plastic/metal laminates for low and medium-temperature collectors. Improved thermal conductivity and dependability in heat transfer materials and fluids with the potential to provide substantial improvements in technical performance and reliability will be investigated.

Central Receiver Technology research will include test and evaluation of components and subsystems at the Central Receiver Test Facility. This activity will provide valuable systems information on the integration of advanced heliostats, receivers and associated controls. Research will also be performed to determine materials and assembly integrity to better define the technical risks associated with adapting the central receiver design to industrial process heat applications. Data collection activities will continue at the Barstow facility to validate operating conditions and system reliability for central receiver power.

Heat Transfer Systems Analysis studies will continue to assess thermal and reliability performance. Specific approaches for using solar technology for interior lighting of buildings without adversely affecting cooling loads will be examined and measured in detail. Research to better understand the process and extent of thermal transport in solar buildings will also be conducted.

PHOTOVOLTAIC ENERGY TECHNOLOGY

The purpose of the Photovoltaic Energy Program is to enhance scientific understanding of the technology and provide a basis for the advancement of photovoltaic systems for both dispersed and centralized electric applications. Research is focused on the characterization of photovoltaic materials, and on devices and advanced concepts which show promise for improved efficiency, stability and cost.

Important advances have already been made in the photovoltaic technologies. For example, amorphous silicon now offers the potential for ultimately lowering photovoltaic cell costs at high volume production rates. During 1982, laboratory efficiencies of 10% were achieved with small area amorphous silicon cells, representing a significant technical advance over the unacceptably low conversion efficiencies previously attained. Reliability of photovoltaic cells, materials and modules is also addressed in the DOE program on an ongoing basis. Through the program, module tests and design algorithms were formulated to simulate 20 year lifetimes and the performance of state-of-the-art modules was tested using these techniques. The validation of these accelerated life tests and algorithms provides a basis for the testing of flat plate modules to project reliability.

During FY 1983, the effort to develop crystalline silicon PV cells will near completion. This effort will include the operation and evaluation of a facility which has been designed to produce semiconductor grade silicon at less than one-half the cost of other methods. Band structure calculations for copper indium diselenide ($CuInSe_2$) thin film PV cells will be completed this year. Based on this research, a laboratory test cell is expected to show an efficiency of 12 percent. This will be the highest efficiency achieved to date in a thin film polycrystalline cell.

For FY 1984, the Department is requesting $32.7 million to continue long range photovoltaic research. This includes $20.5 million for Materials Research, $5.7 million for Cell Theory and Validation Studies, and $6.5 million for Analysis, Testing, and Reliability Studies.

The Materials Research element will include both Thin-Film

Materials and Cell Research, and High Efficiency Materials and Cell Research. Since thin film materials exhibit potential for greatly reducing cell costs, a number of promising thin film materials and deposition techniques will be characterized and investigated. More specifically, understanding deposition methods for producing uniform, larger area cells with thin film amorphous materials will be pursued to extend the high efficiency achieved in laboratory cells. Advanced deposition techniques will also be characterized to identify those which have the potential to yield a reliable, lower cost thin film device. High efficiency research will emphasize the definition and development of materials and cell concepts with the potential for yielding high conversion efficiencies. These activities include conceptual designs for luminescent devices, the laboratory verification of high concentration Fresnel lens modules, and the characterization of materials for multi-layered cells which may potentially achieve efficiencies of 30 to 50 percent. All of these concepts have shown potential for developing more competitive photovoltaic systems.

In the second major area of research, Cell Theory and Validation Studies, analytical models for predicting and interpreting the performance characteristics of new materials for photovoltaic devices and techniques will be developed. The models should result in an increased scientific understanding of the theoretical framework governing the photovoltaic process and should open the door for identification of additional cell concepts. Cell reliability analyses and tests will be conducted on the conceptual designs, and on sample structures of new cells, to determine potential degradation mechanisms. The results will either confirm the validity of initial designs under consideration or suqgest alternatives for future research.

Analysis, Testing and Reliability Studies will be conducted on various mechanical and electrical module configurations to better understand failure mechanisms in cells, modules and arrays. The results of these investigations will be used to determine the requirements for long lifetime designs of 20 years or more.

BIOMASS

The focus of the Biomass Energy Research Program is to establish a technology base for feedstock production and energy conversion for various biomass feedstocks.

Significant research has already been achieved in the area of biomass energy. Production-related efforts achieved yields of 60 dry tons per acre per year of microalgae during a high-density outdoor cultivation experiment. Accomplishments in the conversion area include the development of a cell-free system made up of photosynthetic components of microorganisms with high photobiological efficiency for splitting water into hydrogen and oxygen. In anaerobic digestion, it was observed that rates of methane production could be increased almost twenty-fold by the addition of selected nutrients.

In FY 1983, production-related research will focus on screening, characterizing, and cultivating promising microalgal species for increased oil production, as well as improving yields of short rotation woody species through genetic selection and cloning. In conversion, research is being conducted on the mechanisms of thermochemical reactions, anaerobic digestion, and biological hydrogen production. Research activities will also be conducted in alcohol fuels on integrated system designs, gasification and acid hydrolysis of feedstocks. In-situ methane gas generation research and environmental emissions research for energy from municipal waste will be completed in FY 83.

The FY 1984 budget is $17.3 million. This includes $1.0 million for Production, $12.1 million for Biochemical Conversion, and $4.2 million for Thermochemical Conversion research.

Production R&D will focus on small scale experiments to screen the capability of various microalgae species to produce measurable quantities of petroleum. The data acquired will be used to select or identify the best species for fuel production from aquatics.

Biochemical conversion experiments will be conducted on the characteristics of microorganisms and used to enhance the development of anaerobic digestion, fermentation, and hydrogen conversion processes. These processes offer potential for low-cost liquid and gaseous fuels from renewable resources. Nutritional requirements of anaerobic digesters and pretreatment methods will be examined to determine methods which will increase methane yields, enhance reactor stability, and increase the digestability of the feedstock.

A study of technology capable of improving the efficiency of liquid fuels production will also be conducted.

In Thermochemical Conversion, research will involve the determination of the mechanisms, kinetics, and thermodynamics involved in thermochemical conversion processes. This information is a necessary first step in understanding the fundamentals of advanced thermochemical conversion. Activities will include basic research to improve processes for pyrolysis, direct liquefaction, and gasification of biomass feedstocks.

WIND ENERGY TECHNOLOGY

The Wind Energy Technology Program supports research on performance and lifetime characteristics of wind machines for application by the private sector and develops and validates structural and aerodynamic models to increase the overall understanding of wind as an energy resource.

Several successfully concluded activities have contributed to the establishment of a wind technology base. Small wind system research and development has resulted in improved machines that help foster the growing small wind industry. In large wind turbine research, initial structural, aerodynamic and environmental tests were conducted at the MOD-2 three unit cluster at Goodnoe Hills in FY 1982. We believe that large scale wind turbines will eventually lower the cost of electricity in utility applications as compared to small or intermediate sized machines.

In FY 1983, the program will continue its aerodynamic and airfoil technology efforts since there is a need for more research in complex flow regimes and high angles of attack that are unique to wind turbines. To alleviate deficiencies in the wind system related aerodynamics data accumulated to date, wind tunnel and smoke flow visualization studies are being continued. Success in these research efforts should allow designers to improve performance 20 to 40 percent at certain wind speeds.

The FY 1984 budget request for Wind Energy Technology is $8.6 million. The three major areas of emphasis include $3.6 million for Aerodynamics Research, $3.5 million for Structural Dynamics Research, and $1.5 million for operation of the Small Wind Systen Test Center at Rocky Flats.

In Aerodynamics Research, the request provides for the refinement of analytical techniques and the development of an understanding of unsteady aerodynamics, particularly the effects of atmospheric turbulence and turbine wakes. Continued development of analytic models based on analyses of experimental data will also be funded since test results on experimental turbines have shown that performance, wakes, blade stall, and resulting noise are not consistent with current theory.

In the Structural Dynamics Research area, further validation of advanced structural models; acquisition of fatigue life data from Federal and commercial systems; experimental testing of laminar flow blades and advanced airfoils; and investigation of advanced system configurations will be performed for Darrieus vertical axis systems. Atmospheric fluid dynamics research will emphasize the characteristics of wind turbulence and the resulting effect on turbine aeroelastics. Current ability to predict natural frequencies and structural loads is not adequate to analyze the structural dynamics of advanced wind turbines, particularly new turbines with variable rotor speed. An annual update to the Comprehensive Program Management Plan required by the Wind Systems Act, Public Law 96-345, will also be prepared.

The third area of emphasis is operation of Rocky Flats Small Wind System Test Center. The request provides for research testing and operation of the Center for fee-paid testing services to small turbine manufacturers, utility companies, universities, and research laboratories.

SOLAR TECHNOLOGY TRANSFER

The purpose of the Solar Technology Transfer program is to disseminate the results of research and development generated by solar program activities. The information is to be provided in a format that is easily understood by industrial, scientific and technical audiences.

In FY 1983 the program continues to publish important technical documents which address solar energy technologies. For example, a series of publications reporting the results of solar heating and cooling R&D over the past decade is now being prepared.

The FY 1984 request of $3.1 million includes $2.5 million for Solar Technical Information; $0.3 million for Reproduction and Distribution; and $0.3 million for Mandated Reports.

Solar Technical Information will support information product planning and development, data compilation and information transfer services by the Solar Energy Research Institute. The Reproduction and Distribution activity will provide printing, abstracting, preparation of copies, and distribution of reports and documents. The Mandated Reports effort will support the compilation of publications required by law.

GEOTHERMAL

The long-range direction of the Geothermal Energy Program is to emphasize activities that will reduce the technical risk associated with exploiting the geothermal resource base.

Important advances made through the Geothermal program have successfully removed many technical barriers to harnessing geothermal energy. Program activities completed recently include connection of the deep hot dry rock wells at Fenton Hill; the development of improved geothermal drilling systems; and the completion of short term testing of geothermal resource characteristics at various sites.

In FY 1983, construction will begin on the 50 megawatt binary-cycle plant at Heber, California. Support will also be provided to complete the flow testing of geopressured design wells; begin operation of the interim hot dry rock loop; improve techniques to estimate reservoir capacity; and to continue the development of geothermal energy conversion technology.

The FY 1984 budget request is $13.5 million. The budget includes $5 million for Hot Dry Rock research; $4.4 million for Hydrothermal research; $2.6 million for Hard Rock Penetration research; $0.8 million for Magma Energy Extraction research; $0.1 million for Geothermal Technology Transfer; and $0.5 million for Program Direction.

The Hot Dry Rock element will focus on completion of the Phase II thermal loop at Fenton Hill, New Mexico, which will provide a deep-fractured system for heat extraction. The Phase II loop will be operated for an extended period to assess reservoir longevity, operating performance, and environmental effects.

Hydrothermal research efforts will address brine injection technology, reservoir definition, and heat cycle research. Brine injection technology development is required for extending reservoir life and for the disposal of spent brines in an environmentally acceptable manner. Heat cycle research will involve the evaluation of second generation binary cycle systems required for the generation of electricity from moderate temperature hydrothermal resources. Reservoir definition activities will concentrate on techniques to locate, characterize, and manage hydrothermal reservoirs.

Hard Rock Penetration research will concentrate on fundamental technical problems related to severe downhole drilling conditions. The program will study the mechanics of rock penetration; borehole mapping; drilling instrumentation and data transmission; and the use of high temperature polymers for fluid loss control.

In FY 1984, the Geothermal Energy Program will take lead responsibility for Magma Energy Extraction research following the successful completion of the energy extraction experiment conducted by the Office of Energy Research. The initial focus of this effort will be to identify the major magma prospects in the U.S. and then to assess the feasibility of exploiting these resources.

In Geothermal Technology Transfer, results of agency-sponsored research and development will be made available to scientists, engineers, industrial users, educators, and other decision makers to foster the utilization of geothermal technology.

GEOTHERMAL RESOURCE DEVELOPMENT FUND

The Geothermal Resource Development Fund (GRDF) was established to accelerate the development and utilization of geothermal energy by promoting competition and encouraging new entrants into the market.

The FY 1984 budget request for the GRDF is $2.1 million. The funds will be used for interest differential payments and program direction.

ELECTRIC ENERGY SYSTEMS

The Electric Energy Systems (EES) program provides long-range technology options for improved generation, transmission, and distribution of electric energy to assist utilities in maintaining a reliable electric energy supply during normal and emergency conditions.

Past research activities on electric energy systems have resulted in advancements that have been incorporated into utility equipment and systems. For example, new automatic software for generation control is now in use. Additionally, a high-speed circuit interruption concept is being incorporated into a range of electric substation switching devices.

During FY 1983, EES activities will continue to support research into high voltage system phenomena such as the aging of insulation systems; the formation and performance of low loss amorphous magnetic materials; the reaction of electromagnetic pulse transients with EES systems; and the affect of electric transmission on the health and safety of the public.

The FY 1984 budget request for Electric Energy Systems is $12.7 million. This includes $2 million for Electric Fields Effects research; $4 million for Power Delivery Reliability R&D; $6.6 million for Systems research; and $.1 million for Program Direction.

Electric Fields Effects research will focus on the identification of potential human health problems associated with high-voltage electric fields. Results of this research will be used to assist in resolving problems associated with the location of existing and proposed high voltage power lines.

The Power Delivery program emphasizes new materials with which to design more efficient, reliable, and less expensive equipment for power transmission. Research on the mechanisms of deteriorization of insulating materials will be completed in FY 1984.

In Systems Research, the impacts of electromagnetic pulses on interconnected electrical systems will be examined with particular emphasis on systems assessments. New concepts and materials to protect the electrical power system against pulse surges will be identified as well. The design of a high voltage direct current deepwater cable will be completed and verified. Full power tests on super conducting cables will be completed in FY 1984 and impulse tests and system evaluation during transient operating conditions will be initiated.

ENERGY STORAGE

The Energy Storage program provides long-range research in battery storage technologies for utility load management, photovoltaic and wind energy systems, and for electric vehicles.

Research and development advances in the field of energy storage include completion of a 7 MWh molten salt storage experiment, performance testing of a sulfuric acid chemical heat pump, and research on new electrolytic reduction techniques.

In FY 1983 a 20 kWh zinc-bromine battery will be developed in cooperation with private industry. Research will focus on the technical feasibility of mechanically refueling an 8-cell aluminum-air module. Bench testing of a 30 kWh sodium-sulfur battery for electric vehicles will be completed in FY 1983.

The Energy Storage program requests $14.2 million in FY 1984. This request includes $14 million for Electrochemical Research and $0.2 million for Program Direction.

Activities in the Electrochemical area will continue to emphasize battery research which will provide reliable, safe, and environmentally acceptable high performance electrochemical storage systems. Zinc-bromine and sodium-sulfur batteries will be emphasized since these batteries show a high potential for meeting the requirements for stationary and vehicular applications. Supporting research will concentrate on developing a state-of-charge monitor and on improving performance and life. Research will also concentrate on problems of container corrosion and improved methods for fabrication of beta-alumina elecrolyte. The National Battery Test Laboratory will be maintained as a means of testing battery modules and subsystems under controlled conditions to determine operating characteristics of electrochemical systems.

CONCLUSION

The proposed fiscal year 1984 Department of Energy budget for technologies subject to the jurisdiction of the Energy and Water Development Appropriations Subcommittee reflects DOE's firm commitment to energy R&D activities. The technologies and projects included are component parts of a streamlined, comprehensive approach to emphasizing long-term, high-risk research activities which lie outside the capacity of the private sector to support.

Mr. Chairman, this concludes my formal statement. I would be pleased to respond to any questions that either you or the other members of the Subcommittee may have regarding the Department's 1984 budget for these energy technologies.

BALANCED ENERGY PROGRAM

Chairman HATFIELD. Thank you, Mr. Secretary.

Last week, Secretary Hodel testified before our committee. In his testimony, he indicated what he considered to be the importance of maintaining a mix and balance in energy sources.

As I read the budget request that has been presented to the committee, in the solar and the conservation budget, these two particular areas, there seems to be a continuing assault on the R&D spending programs with about a 60- to 70-percent cut in the congressionally supported 1983 levels. Now, that certainly does not give to me the impression of a balanced program in terms of energy sources.

Could you comment on this perception that I seem to have, whether it is accurate or not and whether or not you really feel that this does represent a so-called balance of energy sources?

Mr. TRIBBLE. A large part of the reduction from the appropriated amount for 1983 and the amount of our budget submission is reflected by the change from building expensive hardware projects and toward research.

A number of the hardware projects that we have been building are reaching the point where, in 1984, we will not need to spend additional money on them.

We are, therefore, probably getting more research with the budget submission we have proposed than we would under the old arrangement where a large portion of that was going for hardware installations.

This does not say that your impression is wholly wrong. It is simply an explanation of a part of the difference that gives the perception, if you just look at the numbers, that we are, in fact, cutting the program quite severely.

The proposals that we have here are the result of our culling from a very large number of proposals those that we felt were most productive, and we are attempting to go forward with whatever research is needed to advance the technology in each of these areas.

We are trying to stay in close contact with the industry; we are trying to get feedback from them as to the things that they feel are necessary and we are trying to fill the gaps where research is needed.

SOLAR ENERGY BUDGET

Chairman HATFIELD. I'm not sure that I fully understand. Let me approach it this way: How much hardware or demonstration money do you have in your budget request for active solar?

Mr. TRIBBLE. Not any for demonstrations.

Chairman HATFIELD. None?

Mr. TRIBBLE. Some for research.

Chairman HATFIELD. And I am talking about 1984.

Mr. TRIBBLE. Yes.

Chairman HATFIELD. How much for passive and hybrid solar?

Mr. TRIBBLE. In the budget for 1984, we have included some of the activity that would otherwise be in that category in the solar heat classification inasmuch as it is still solar heat.

We have, of course, cut down, and in direct answer to the question, we have $4 million for passive solar as such.

Chairman HATFIELD. But in 1983, where were you in these two categories in fiscal year 1983?

Mr. TRIBBLE. Let's see if I can find that quickly.

Chairman HATFIELD. You had money in 1983.

Mr. TRIBBLE. Yes, about $11 million.

Chairman HATFIELD. The point I am making is that in 1983 you had funding for these two particular programs.

Mr. TRIBBLE. In fiscal year 1984, we are using the solar heat budget category to support low- and high-temperature solar R&D.

Chairman HATFIELD. Right; how much money in 1984 in these two categories?

Mr. TRIBBLE. $8 million.

Chairman HATFIELD. What about international solar?

Mr. TRIBBLE. International, the principal need for money in the fiscal 1983 timeframe was for the SOLERAS program, and our request there was for $9.5 million. That will conclude the arrangement that we have with the Saudi Arabian Government in fiscal 1983 so that we do not have any need and have not made a request in that category.

Chairman HATFIELD. So that is zero in 1984?

Mr. TRIBBLE. Yes, sir.

GEOTHERMAL BUDGET

Chairman HATFIELD. What about hydrothermal industrialization in geothermal? In 1983 you had money; in 1984, none. Correct?

Mr. TRIBBLE. That's right.

Chairman HATFIELD. That's right, so that is zero in 1984?

Mr. TRIBBLE. Yes, sir, right.

Chairman HATFIELD. What about geopressured resources in the geothermal field? Is that not the same pattern? You had money in 1983 but none in 1984?

Mr. TRIBBLE. That is right. We have the four design wells with which we would expect to go forward with the fiscal 1983 dollars and get the information that we originally set out to get with 1983 money.

Actually, one of the wells, we feel, may be self-sustaining in that there is some gas production; it is being sold, and it may very well continue beyond. One of the other wells we have had to plug on account of it becoming sanded, but nevertheless, in the pro-gram we expect to get the information with the 1983 dollars that we were anticipating, and we have made no request in 1984.

Chairman HATFIELD. So, for whatever reasons, if you take the categories of international solar and hydrothermal and geopressured resources under the geothermal, these programs in 1983 had funding, but in fiscal year 1984, it is now excised?

Mr. TRIBBLE. Right.

REQUEST TO OMB

Chairman HATFIELD. Mr. Secretary, let me ask you this question. Did you make requests for funding in these categories for fiscal year 1984, and if you did, where were they excised?

Mr. TRIBBLE. I am under the impression that we did not make a request, and let me double check that.

Chairman HATFIELD. All right. Would you provide that for the record? I would like to know if they were excised at the departmental level or whether they were excised at OMB?

Mr. TRIBBLE. We did not make a request.

Chairman HATFIELD. You did not make the requests?

Mr. TRIBBLE. That is right, and generally speaking, we got approval by OMB on everything that we submitted.

Chairman HATFIELD. That wouldn't be very difficult if you had a zero——

[Laughter.]

Chairman HATFIELD [continuing]. Not to in any way denigrate your accomplishment of getting through OMB, the hurdles at OMB.

Mr. TRIBBLE. I thought that was quite an accomplishment.

Chairman HATFIELD. That's like running a race with 1-foot-high hurdles.

OIL PRICES

Can you tell me a little bit about the situation that we are now in regarding temporary lowering of oil prices and renewable energy research? Shouldn't we, at this particular time, be reexamining the need for the level of Federal support for alternative energy supplies, resources, and projects? In other words, wouldn't the private sector be a little less likely to pick up and continue the development of these renewable resources?

Mr. TRIBBLE. I think so, yes. I think that very few of us, if any, feel that the present circumstances are going to be very long lasting.

Chairman HATFIELD. That is right; that is, the diminishing oil prices.

Mr. TRIBBLE. Yes, that is right.

Chairman HATFIELD. What is your projected time frame on that, by the way? Have you given any thought to that?

Mr. TRIBBLE. Mr. Chairman, I have been giving thought to that for the last 10 years, most of which time I was in the private sector and had responsibility to project oil prices. Every projection I have ever made was wrong. I certainly am no better expert now.

On the other hand, I think that the research that we are doing in renewables will certainly be valuable to us at the time when the price of oil does, again, escalate. As you know——

Chairman HATFIELD. Doesn't that really argue against any deferral or recission of these programs, or the nonapproval of them?

Mr. TRIBBLE. Yes. We think that we should go forward with the research that we are proposing because there will be a substantial time frame between the time of the research being done and the results of the research being implemented on any large scale.

We think that by the time the research that we are proposing to do now bears fruit, it will be very valuable to us in permitting the renewable sources of energy to help meet the demand when and if the price of oil again goes up.

Chairman HATFIELD. Mr. Secretary, let me share with you a concern of mine, because I think that we tend to get misled at times on some of these trends or some of these actions that occur such as the present low oil prices. They tend to lull us into a sense of false security. But let me paint a scenario that I think is not impossible. I would hope it would not happen, but—and I'm not issuing an invitation for it to happen—but I just think we ought to face up to the reality that if these oil prices continue to diminish and we see some fiscal crisis as a result in the oil-producing countries, the geopolitics of that far transcends the economic implications, in my view, where I can see a possible scenario where the depletion of oil prices or the diminishing oil prices could create immediate or could create a fiscal crisis that could trigger a political crisis, and the fragile character of some of the political structures that we are looking at in those oil-producing countries could then lead to, not a question of increased prices, but the possibility of a total interruption of that oil supply.

Is that a reasonable, possible scenario that I have painted?

Mr. TRIBBLE. I would think that that certainly is a possibility among many of the nations, and quite possibly among several of them at one time.

There is a countervailing influence, and that is in the last figures that I have seen, our imported oil amounts to 4.3 million barrels a day, as compared with 8.7 back in 1977.

Chairman HATFIELD. And that is still 20, what, percent of our demand?

Mr. TRIBBLE. That is, I believe, about 14 percent of our demand.

On the other hand, a large part of that is coming from Mexico, Venezuela, and the North Sea, so that we are not nearly as vulnerable to the interruptions among the Arab OPEC nations as we at one time were.

Another factor is that in the Strategic Petroleum Reserve, we do now have in excess of 300 million barrels of oil which would help through a relatively short period of crisis.

Chairman HATFIELD. Certainly, but the kind of crisis I am talking about I am not so sure would be a short-term crisis. You know, I wouldn't eliminate those Latin-producing countries from a political crisis in the future. I think all you have to do is look at El Salvador today and these other areas to show it, again, similar fragile geopolitical scene.

It just seems to me that we have a tendency in times of lowering prices and more conservation, less consumption, all of that, to think that maybe we are over the hump or have solved the problem. We need to be pushy, in my view, on the renewable side, the conservation side, all these other sources that truly reduce the dependency on the imported energy and loosen that noose around our neck.

Mr. TRIBBLE. I agree with that, and I think that the program we are proposing does, in fact, do that. We, as I mentioned before, are trying to determine what the gaps are in the research that is needed to move these technologies forward, and we are trying to fill those gaps.

Chairman HATFIELD. I accept the sincerity of your comment, the integrity of your person, but I must say that when I look at these reductions in those areas that I listed, it doesn't seem to me that we are doing a very—that we are as aggressive—let me put it this way—that we are as aggressive on some of those fronts as I think we should be.

You may end up with a little more money than you asked for.

SUSANVILLE GEOTHERMAL PROJECT

Let me ask you, now, on behalf of a couple of my colleagues, some specifics. In December we passed the continuing resolution which directed the Department to spend $2.5 million to complete preconstruction of this project near Susanville, Calif.

The question is, What is the progress of this project?

Mr. TRIBBLE. When you ask me a tough one, I am going to throw it to my friend, if I may ask Dr. San Martin to answer this.

Dr. SAN MARTIN. Mr. Chairman, as I believe you know, we do have $2.5 million in our budget for possible future work on that particular project. If you recall, that project began in 1979 and it has received, first, $425,000 of the Department of Energy feasibility study money; it has received $650,000 from the California Department of Resources; $267,000 from the U.S. Forest Service, and in addition to that, it is currently under contract to the Department of Energy for $1,350,000 for characterizing and exploiting the geothermal field itself.

My current records show that the contractor has costed approximately $0.5 million in the contract, and they have notified us that they have reached a point of obligating three-fourths of the money.

We received from them, Mr. Chairman, a proposal to continue the work even further, to the tune of $2.5 million.

We have that proposal under current review and expect soon to be able to respond to the contractor.

REGIONAL BIOMASS PROGRAM

Chairman HATFIELD. Could you comment on the regional biomass program which we authorized or appropriated, I think, around $4 million in fiscal year 1983?

What is the progress of implementation of that program and particularly, I think it broke out about $1.4 million that was provided for Region X in the wood-derived fuels program to be transferred to the BPA.

Have these funds been transferred to BPA?

Mr. TRIBBLE. These hearings produce great results, Mr. Chairman; I signed off on that this morning.

Chairman HATFIELD. Oh, very well timed. [Laughter.]

We should have had this hearing a little earlier. [Laughter.]

Thank you.

SALEM PLAZA GEOTHERMAL PROJECT

Senator Laxalt specifically wants, though, for the record, to talk a little bit about the Salem Plaza geothermal heating project in Reno, Nev. He has three questions, but let me just pose one now and let you respond to the other two for the record.

When does the Department anticipate providing the final response to the Nevada congressional delegation's letter about the project which was sent to Secretary Hodel on January 14?

Would you like to check that out, or do you know about that?

Dr. SAN MARTIN. Mr. Chairman, we are very aware of that particular letter. We had hoped to, by now, to have been able to respond to the Nevada delegation. That particular contractor has requested additional funds for a cost overrun on that contract.

When we received the letter from the Nevada delegation, we have instituted a substantial review, at their request, of the project itself. The contractor has received a request for additional technical and cost facts so that we could deliberate on the subject.

We are awaiting the arrival of that information so that we can formulate an accurate response back to the Nevada delegation.

Chairman HATFIELD. What we try to do—and let me just sort of gratuitously share this thought with you—we get a lot of mail from constituents and we find ourselves in a similar situation in matters of having to research out some of the material or data that has been requested.

We send a little card that such a letter has been received and we are in the process of developing the data, and that tends to relieve the anxiety of the people waiting for the Postal Service to deliver the response.

That gives us some meeting time to get the data.

ADDITIONAL PREPARED QUESTIONS FOR THE RECORD

I have other questions for the record at this point which I will submit to you, Mr. Secretary, for response.

I also will include questions which have been submitted from Senators Inouye, Kasten, Domenici, Laxalt, and Hollings. Without objection, they will be made part of the record at this point.

[The questions and answers follow:]

QUESTIONS SUBMITTED BY SENATOR HATFIELD

Tax Credits

Question: In the past, the Administration has repeatedly indicated that tax credits will assist the development of solar and renewable technologies and reduce the need for federal spending for R&D.

I agree with this approach, but last year you proposed elimination of these tax credits. This year, after receiving a clear message from Congress, of tax credit support, termination of the renewable tax credits will not be proposed again. Is this your understanding?

Answer: It is my understanding that the Department does not intend to propose the termination of renewable tax credits.

Question: What is your view of the need to continue or even extend the tax credits?

Answer: Existing tax credits have been beneficial to renewable energy technologies to date. DOE supports an extension of the tax credits in principle. In concurrence with ERAB recommendations, if the credits are extended to 1990, the benefits of a phasedown strategy after 1986 should be carefully considered for particular solar technologies.

In the national economic environment, comprehensive tax policy issues are the responsibility of the Department of Treasury. We will provide Treasury with whatever data or insights we have regarding energy tax credits proposals to assist them in the formulation and level of national tax policy initiatives.

General

Question: Last week, Secretary Hodel testified on the importance of maintaining a mix and balance of energy sources.

In the solar and conservation budget, however, the assault on R&D spending programs continues with a 60-70% cut in the Congressionally supported FY 83 levels. This gives the impression of an unbalanced energy R&D program.

At the same time that we are cutting our civilian R&D programs Germany, Japan, and France are increasing substantially their research budget for alternative energy. The new multi-billion dollar business to produce and market renewable energy systems, and more energy efficient products could be lost to our foreign competitors. Our lack of Federal commitment seems to be short-sighted policy that truly threatens our position in the world markets. Are you concerned?

Answer: The current Federal program is aimed at continuing long-range advanced research efforts for renewable energy technologies. DOE is not involved in examining or predicting future markets, domestic or international, for these R&D concepts. We have seen information, however, from various sources that the international market will be growing at a healthy rate.

While the current Federal program focuses precisely on those advanced research areas that will ensure that long term technological leadership is maintained, private sector investments appear to be increasing at a rate conducive to maintaining near term technical superiority. In some cases, foreign governments may subsidize their renewable energy industries and, thus, artificially lower renewable energy costs. For a number of reasons, it is fair to conclude that our exclusive hold on international markets may begin to erode on a percentage basis. However, we believe, particularly in light of our solid commitment to research, that every reasonable opportunity exists for U.S. industry to increase its renewable energy sales both at home and abroad.

This should occur because the Federal program emphasis is on long-range high-risk concepts. The results we achieve through our efforts will enable the U.S. to continue to maintain the technological lead over our competitors and enable U.S. industry to be in a favorable position to expand sales. In addition it is important to note that U.S. companies are active in establishing foreign subsidiaries to that they will continue to benefit from in-country market growth.

Active and Passive Solar

Question: In FY 1982, the Department reported very high returns on passive solar programs - a yield of 40 to 1 for each Federal dollar spent. In view of this high return, explain why the program is proposed for termination?

Answer: The passive solar program is not being terminated in FY 1984, it is being consolidated with active solar and solar thermal thermal as a single program in the FY 1984 budget request. A number of research activities within the Solar Heat Technologies program represent a continuation of elements within the current passive solar program. Examples of such planned research include research to develop high transmission/high insulation glazing materials, aperture materials research, heat transfer systems analysis, and better definition of solar daylighting principles. The focus of the research activities related to passive solar will continue to be on long-range, high-risk research.

Question: In your view, is there any federally supported research-long-term, high risk -- that should be undertaken in the active or passive area?

Answer: During FY 1984, a number of long-term, high-risk R&D activities related to active and passive solar technology are proposed for funding as part of the integrated Solar Heat Technologies program. The active and passive programs have been redefined to meet long-term, high-risk R&D objectives. Consequently, the research planned for FY 1984 emphasizes research on new materials and heat transfer systems analysis.

Question: Is there a legitimate federal role to be exercised in the dissemination of information and technical assistance?

Answer: The budget request for FY 1984 includes the Solar Technology Transfer program, which seeks to assure that results of solar energy research and development sponsored by the Department are made available to scientists, engineers and decision makers in the public and private sectors. In addition, each solar program includes information transfer and dissemination activities geared to that program and DOE is supported by the national laboratories in carrying out technology transfer activities.

Geothermal R&D

Question: As you know, Congress strongly supports the geothermal demonstration plant at Heber, California. What is the status of the Heber binary cycle project?

Answer: The Department of Energy and our industrial partner, the San Diego Gas and Electric Company, have consistently supported this project. Excellent progress has been made since the signing of the Cooperative Agreement in September 1980. Ground-breaking ceremonies were held at the project site on November 22, 1982, and orders have been placed for many long-lead items such as the turbine-generator. While the Heber project will continue to present periodic engineering challenges, there are no known technical obstacles to the project's completion. The project is on schedule and the plant is expected to be completed in 1984, with the test and evaluation period completed by early 1988. I am confident that the project will provide the incentive the geothermal industry needs to expand their involvement in binary technology.

Geothermal Loan Guarantee Program

Question: The Senate Report on the FY 83 Appropriations Bill called on DOE to complete action on loan applications and directs the Department to report on the disposition of pending applications at the time of submittal of the FY 1984 budget request.

Have you completed the report?

Answer: The report has been completed and is in final Departmental review.

WIND ENERGY

Question: As you know, there are some additional problems with the Mod-2 wind turbines in Washington State -- the first experimental cluster of large wind machines. Please briefly discuss the problems and their impact on the FY 1983 and FY 1984 budget allocation.

Answer: To date, the DOE-sponsored Mod-2 wind turbines comprising the cluster at Goodnoe Hills, Washington, have been operated over 3,400 hours during initial testing, generating about 4 gigawatt hours of electricity while synchronized to the Bonneville Power grid. Although initial structural, aerodynamics, and environmental tests were successfully conducted at the Mod-2 cluster in FY

1982, presently the cluster is not operating because of a failure in the low speed shaft which is an integral part of the power train. Corrective actions have been recommended and are presently being incorporated in a redesigned shaft. The wind turbine cluster will be repaired in FY 1983 and full test operations will occur in FY 1983 and FY 1984 using FY 1983 funds. An additional allocation under the continuing resolution was made for the repair of the Mod-2 facility. Research tests on wakes, aerodynamics, structural dynamics, microscale turbulence, acoustic noise, and electrical parameters are planned.

Question: In FY 1983 Congress provided $18 million for the Mod-5 wind turbine program. The private companies, I believe, have agreed to 50/50 cost sharing on the project.

Do you believe that these machines are a logical next step in the development of large wind turbines?

Answer: The Department believes that the scale of these machines and advanced features such as the variable or multiple-speed operation and innovative rotor designs represent advances in large wind turbine technology and that Mod-5 is therefore a logical step in the development of large wind turbines.

Question: In your view, will these Mod-5 machines lower the cost of electricity in utility applications as compared to the other large machines or smaller wind turbines?

Answer: It is believed that larger scale turbines will lower the cost of electricity as compared to small or intermediate size machines.

Question: Are additional funds required in FY 84, to complete the Federal government's share? If so, how much?

Answer: No additional funds are requested for FY 1984. Negotiations with the other participants should enable the government to complete its commitment without any new funding.

Question: Please discuss the problems which the private companies believe they will have if there is a delay in the Mod-5 program.

Answer: There is no technical reason for a delay to occur in the Mod-5 program. The Department is continuing to support the design and component development testing of the two prototype machines. It will be the responsibility of industry to complete the design, fabrication, installation, and operational testing of the prototype machines.

Question: Please provide to the Committee a breakdown of all wind activities in the FY 1983 and FY 1984 budgets with funding levels for each item.

Answer: I will submit a copy of this information for the record.

Wind Energy Technology
FY 1983 and 1984 Funding

	($Millions)	
	FY 1983	FY 1984 Request
Aerodynamics Research		
Large Systems Research and Technology Development	0.9	1.8
Darrieus Vertical Axis Research	0.7	1.2
Environmental Research	0.1	.3
Atmospheric Fluid Dynamics	0.5	.3
	2.2	3.6
Structural Research		
Large Systems Research and Technology Development	1.0	1.0
Darrieus Vertical Axis Research	0.9	1.9
Atmospheric Fluid Dynamics	0.4	0.3
Wind Systems Act Studies	0.7	0.3
	3.1	3.5
Environmental Systems		
Mod-2	6.0	-
Mod-5	18.0	-
	24.0	-
Small Wind Systems Test Center	2.0	1.5
Capital Equipment	0.1	-
	31.4	8.6

BIOMASS

Question: In FY 83, Congress provided $4 million for regional biomass programs. How are you doing with respect to implementation of that program.

Answer: DOE is currently studying various approaches to meeting the requirement for a Regional Biomass Energy Program. In addition to BPA's program in the Northwest, TVA will be requested to recommend a program for the Southeastern U.S. Programs are also being considered for other regions of the country.

Question: Have funds been provided to TVA and to the other regions?

Answer: At this time, no funds have been provided to TVA or the other regions. Program funding will be based upon the eventual approach developed by DOE to meet the regional program requirement.

Question: For the record, provide a detailed breakdown and justification of the biochemical conversion activities and funding for each activity in FY 82, FY 83, and the FY 84 request.

Answer: I will be happy to provide this information for the record.

Biomass Biochemical Conversion Funding
($ in millions)

	FY82	FY83	FY84*
Biomass Energy Technology Division	3.5	4.0	12.1
Office of Alcohol Fuels	5.3	4.3	—
Energy from Municipal Waste Division	1.6	0.9	
Total	10.4	9.2	12.1

FY 1984 integrated Program includes research in alcohol fuels and municipal waste, as well as biomass

Justification of Biochemical Conversion Research

The Biochemical Conversion Program focuses on research problems directly related to the production of high-value gaseous and liquid fuels from biomass feedstocks utilizing biological methods. Microorganisms can convert a wide variety of biomass feedstocks including those with high moisture content to highly specific energy products under mild conditions with high efficiencies.

The major problems with biochemical conversion technologies focus around slow conversion of particular feedstocks and sensitivity to environmental factors such as pH, temperature and high salt levels. The development of improved microbial strains, cost-effective pretreatment methods and more efficient reactor configurations will alleviate these problems and allow development by the private sector. The long-term potential of biochemical conversion is tied directly to resource availability as with all conversion processes.

FY 1984 Activities in Biochemical Conversion

- Experiments to characterize hydrogen biochemical conversion systems and to determine the source of reactions of hydrogen ions. Key process rate limiting enzymes involved in lipid metabolism will be isolated and characterized. Feasible methane producing processes will be clarified. Enzymes involved in the metabolism of five-carbon sugars will also be studied. ($1,000,000)
- Experiments to characterize bacterial chromosomes involved in conversion of biomass to energy. This information will be used to develop organisms which are capable of storing 80% lipids, to study methanogens which can convert high concentrations of acidic digester intermediates to methane, and to investigate organisms that can digest and convert both hemicellulose as well as cellulose. ($1,000,000)
- Research on the nonresponsive nature of lignocellulosic materials to discover how the cellulose can be accessible for hydrolysis to glucose. ($1,000,000)
- Selection and improvement of microbial strains to increase liquid fuel production. After identification of these species, nutritional characterizations will be conducted to optimize the growth of these organisms. ($3,600,000)
- Applied research on the improvement of microbial strains, cost-effective pretreatment methods the study of nutritional requirements necessary to enhance yields and reduce the time for digestion. ($1,500,000)
- An examination of both mesophilic (mild temperature) and thermophic (high temperature) enzymatic systems for conversion of biomass to liquid fuels. Single organisms will be sought that both hydrolyze biomass and convert intermediate reaction results to liquid fuels. ($3,000,000)
- A study of techniques capable of providing for the efficient separation/recovery of liquid fuels. ($1,000,000)

FY 1983 Activities in Biochemical Conversion

Biomass Energy Technology Division

- o To provide a better understanding of biological methanogenesis as an alternate energy conversion technology through a combination of research projects. Research will be conducted to expand knowledge of methanogens for strain improvement by traditional genetics and emerging recombinant DNA techniques. Research will also be conducted on how methanogens transfer genes, cellular regulatory mechanisms that govern the kinetics, amounts of various metabolic products, and various metabolic pathways. Organisms will be developed for high yields and rates of methane production on a wide variety of substrates with reduced sensitivity to environmental factors such as pH, temperature and high salt levels. ($1,500,000)

- o To examine hydrolysis pretreatment methods for enhanced biological digestability and methane production. Anaerobic fermentation systems for high conversion efficiency and rapid kinetics, including two-stage and low moisture reactor configurations, will also be explored on a laboratory scale. ($1,000,000)

- o To conduct research on methods to produce high yields of hydrogen by phototropic microorganisms at the expense of light energy and electron-donating substrates such as municipal sewage effluent and other waste streams. Photosynthetic bacteria and blue-green algae will be examined through species isolation, genetic mapping, and basic genetic engineering techniques for enhanced photobiological hydrogen evaluation, biological stability and reduced oxygen sensitivity. The necessary research will be conducted to provide a better understanding of the transport and the primary photochemistry, of photosynthesis ($1,500,000).

Office of Alcohol Fuels

- o Conducted a comprehensive assessment of pretreatment techniques for relevant feedstocks, based on experimental results. Evaluate by-product separation techniques and their use ($400,000)

- o Fermentation research will transfer genes from bacteria responsible for pentose fermentation to industrial strain yeasts. Perform genetic engineering experiments to increase yield of cellulose converting organisms. Conduct genetic engineering experiments on organisms for high temperature fermentation ($2,000,000)

- o Assess alcohol/water separation approaches. Test adsorption system as part of acid hydrolysis experiment ($300,000)

- o Perform integrated experiments to determine total effectiveness of alcohol processes. Issue RFP for integrated systems designs and key developments. On the basis of these studies, a series of integrated technology experiments is contemplated ($1,600,000)

Energy from Municipal Waste Division

- o Conduct research on refuse conversion to methane, including digester parameters, dewatering, and effect of sewage sludge. Test removal efficiencies of pilot ANFLOW system using stronger industrial wastes ($400,000)

- o Conduct research on the basic biochemistry and genetics of anaerobes for conversion of MSW. Determine feasibility of producing short chain organic acids from MSW ($450,000)

- o Determine characteristics of methane, including flame configuration/stability, temperature, combustion efficiency, corrosivity of biogas from landfills and anaerobic digesters ($50,000)

FY 1982 Activities in Biochemical Conversion

Biomass Energy Technology Division

- Conduct exploratory research and develop new concepts for biochemical conversion. Develop innovative anaerobic and aerobic processes to convert recalcitrant biomass feedstocks into competitive energy products ($2,100,000)

- Continue experiments with photochemical conversion processes for increased efficiency and stability in the economic production hydrogen. Develop integrated systems producing hydrogen from easte streams and using it on-site for chemical conversions ($1,400,000)

Office of Alcohol Fuels

- Develop kinetic process data and experimentally verify key hydrolysis, pretreatment, and separation subsystems. The Solar Energy Research (SERI) had a contractor develop a model to assess the University research and development results in terms of overall system cost effectiveness. Two acid hydrolysis processes were identified with excellent potential for further development ($800,000)

- Identify and test several mechanical and chemical pretreatment techniques ($1,100,000

- Conduct fermentation experiments on cheese whey pentose hydrolysis and fermentation and high temperature fermentation. Isolate bacteria and fungi capable of fermenting pentoses ($2,600,000)

- Investigate approaches for reduced energy recurements for alcohol/water separation ($800,000)

Energy from Municipal Waste Division

- Conduct preliminary assessment of the potential of MSW for liquid fuels such as dectane and octane. Continue operation of REFCOM (conversion of MSW directly to methane) and ANFLOW (low-cost, low-energy wastewater treatment) pilot facilities ($1,600,000)

Question: What is the rationale for reducing the feedstock production development research?

Answer: Current biomass funding proposals emphasize conversion R&D over research to enhance the resource base. It appears that industry is in the position to assume responsibility for the development of certain biomass technologies. Factors such as previous success in short-rotation woody crops research, industry involvement in herbaceous energy crops, and the competitive position of wood as a source of fuel, indicate that industry is now in a position to proceed with development in accordance with competitive market forces.

Question: How much is requested in FY 1984 for production-related research?

Answer: The FY 1984 budget request for production-related research is $1.0 million.

Question: How does this compare to FY 83, and what will be accomplished?

Answer: The FY 1983 budget for production-related research was $4.0 million. In the FY 1983 budget, $2.0 million will be used to support aquatic species research and $2.0 million for short rotation woody crops. In the FY 1984 budget, $1.0 million will be used to support aquatic species research.

Photovoltaic

Question: Briefly outline the accomplishments of the PV program over the last five years.

Answer: The Photovoltaics Program has been one of the most successful solar research programs. Its achievements are evident in the changes that have occurred in the photovoltaic industry and in commercially-available collectors. The industry has grown from a few specialty companies supplying tens of kilowatts of manually-produced photovoltaic cells per year to over 40 firms involved in the automated production and yearly sale of approximately 5 megawatts of PV modules today. The cost of these modules has been reduced tenfold, to approximately 5 to 10 dollars per watt.

Numerous technical advances have contributed to these achievements.

Early work in the development of high purity silicon has resulted in the transfer of a 100 metric ton pilot silicon purification plant to private industry for continued operation. This plant is verifying the first of two steps in the silane process and is expected to reduce the cost of semiconductor grade silicon from 60 to 70 dollars per kilogram to less than 40 dollars per kilogram.

Four production techniques have been developed which have reduced the cost of producing silicon sheet from 600 dollars per square meter to 150 dollars per square meter. Further, the efficiency of thick crystalline silicon cells has increased from 10 percent to 18 percent.

These lower cost, more efficient silicon cells are also being packaged into modules more effectively. New designs have extended the lifetime of flat plate modules from one to ten years.

Photovoltaic systems have been verified through a variety of experiments. Twenty-one experimental residential and intermediate size systems have been installed and operated, clearly demonstrating the technical feasibility of these grid interactive applications.

Much of the Federally supported research to develop thick silicon modules has now been successfully transferred to industry. The program is now emphasizing the development of thin film cell concepts which show the potential for very high automation, very low cost, and high efficiency. These concepts may eventually result result in solar cells with conversion efficiencies as high as 30 to 35 percent.

Question: Discuss the efficiencies and other progress which have occurred in the PV area.

Answer: One of the areas of greatest accomplishment in photovoltaic research has been the achievement of increased cell efficiencies for a number of different PV materials. When research first began in the National Photovoltaics Program in 1975, the efficiency of single crystal silicon solar cell averaged 4 percent. The efficiency of commercially available modules was even lower. Today, crystalline silicon cells can be produced in the laboratory with conversion efficiencies of 16 to 18 percent and modules are commercially available with conversion efficiencies of 10 to 12 percent.

Recently, the program has been emphasizing the development of cells which are 1/100th the thickness of typical silicon cells. These complex thin film cells have the potential for very highly automated production and very low cost. In the past, however, thin film cells were at best only 2 percent efficient in converting sunlight to electricity. Today, small laboratory cells of one square centimeter in size have been produced and efficiencies as high as 11 percent have been recorded. For example, a test specimen was recently produced from copper indium diselenide which achieved an efficiency of 11 percent, and an amorphous silicon cell has achieved 10.1 percent efficiency. There is still considerably more work to be done with these materials, however. Cells of a practical size, about 100 square centimeters, are considerably lower in efficiency. Nevertheless, our researchers are confident that at least one of the thin film materials will ultimately achieve the efficiencies of thick silicon cells.

We are also looking at novel concepts which yield very high efficiency cells. While these cells tend to be more expensive than thin films, the higher efficiencies offset the higher cost and may enable PV modules to achieve higher power ratings with less area, thus opening up potentially new applications. A gallium arsenide cell recently produced in a laboratory has achieved a 24% conversion efficiency under concentrated sunlight. Another concept under development, the stacked cell, is expected to result in 30 to 35 percent conversion efficiencies. A stacked cell consists of two or more cells of differing materials. Each cell converts into electricity a range of wavelengths of sunlight that the other cell is unable to convert, thus increasing the total amount of sunlight that can be converted into electricity per unit of surface area.

Question: Congress provided $6.8 million in FY 1983 for the cost shared utility project with the Sacramento Metropolitan Utility District (SMUD). What is the status of the project?

Answer: In August 1982, the Department of Energy entered into a cooperative agreement with the Sacramento Municipal Utility District (SMUD) and the California Energy Commission to sponsor the construction of a one megawatt photovoltaic powerplant. Funds are provided as follows: the Department of Energy, $6.8 million from FY 1982 funds; SMUD, $3.2 million; and the State of California, $2.0 million, for a total of $12.0 million. The project is currently on schedule and within cost, with 80 percent of the funds committed on fixed-price contracts. It is scheduled for a July 1984 completion and is expected to be 50 percent complete by the end of 1983.

Arco Solar of Chatsworth, California, has been named winner of the competition to supply one-axis tracking flat plate photovoltaic modules for the project. Negotiations are underway and a signed contract is expected by the end of April.

Question: Why are no funds requested in FY 1984?

Answer: There are two primary reasons for not requesting further support for the SMUD project in FY 1984.

First, the appropriate role of the Federal program is to support research and development in those areas which private industry is unable to adequately support. The SMUD project does not meet this criterion, especially since a privately-financed one megawatt plant, ARCO-Solar's Lugo Station, California plant, is already supplying power to a utility grid.

Second, the Federal program supports systems experiments to the extent that they are necessary to resolve important technical issues which will not be resolved by industry. Expanding the SMUD project will not serve this purpose. Systems design and integration issues which are beyond the scope of industry will be sufficiently resolved as a result of the Sandia systems research program, residential and intermediate size application experiments, and the first one megawatt of the SMUD project.

Question: Please provide for the record a breakdown of all activities funded in FY 1982, FY 1983, and FY 1984 with the funding level for each item.

Answer: For the record, I will submit the FY 1982, FY 1983, and FY 1984 funding levels for each photovoltaic activity.

PHOTOVOLTAICS PROGRAM FUNDING
(Millions of dollars)

	Actual FY 1982	Planned FY 1983	Request FY 1984
Thin Film Materials & Cell Research	10.4	11.3	11.2
High Efficiency Materials and Cell Research	4.3	8.0	9.3
Cell Theory and Validation Studies	7.2	6.3	5.7
Analysis, Testing and Reliability Studies	10.8	11.7	6.5
Silicon Materials and Cell Research	9.0	6.0	-0-
Balance of System Development	7.6	7.7	-0-
SMUD	6.8	2.0	-0-
Excimer Laser Annealing	- -	1.0	-0-
Headquarters Activities	2.0	2.0	-0-
Other Research Activities	15.9	2.035	-0-
TOTAL	74.0	58.035	32.7

Question: Indicate for the record, the FY 1984 request levels for advanced research, technology development and systems development with activities planned in these areas.

Answer: For the record, I will submit a breakdown of the FY 1984 photovoltaics request by advanced research, technology development, and systems development activities.

FY 1984 FUNDING REQUEST

Photovoltaic Energy Technology Program
(Millions of Dollars)

Advanced Research	FY 1984 Request
Thin Film Materials and Cell Research	11.2
High efficiency Materials and Cell Research	9.3
Cell Theory & Validation Studies	5.7
	26.2
Technology Development	
Analysis, Testing and Reliability Studies	5.5
Systems Development	
Analysis, Testing, and Reliability Studies --Operation of Test Facilities	1.0
Total	32.7

Solar Thermal

Question: Congress provided $4.5 million for repowering final designs in FY 83.

What is the status of this project?

Answer: A program opportunity notice for the final design phase is in preparation based on a $4.5 million FY 1983 funding level. The solicitation will be released in late March.

Question: Is it possible to support two designs with this funding level in FY 83?

Answer: Whether it is possible to support one or two cost-shared final designs will depend upon the extent of cost sharing proposed by bidders.

Question: In order to support cost-shared final designs, how much is required in FY 84?

Answer: The Department does not anticipate any additional funding requirements in FY 1984 for the repowering project.

Question: Briefly discuss the status and the benefits of the Salton Sea Solar Pond project.

Answer: The Salton Sea Solar Pond project is currently in its design phase. In November 1982, a contract was awarded to support A-E designs of the project. The Salton Sea project is being designed with the capability to generate 15 megawatts of electricity. This project is expected to provide valuable information on the technical and operational characteristics of solar ponds. In addition, it is expected to have extremely favorable environmental impacts because the project will help to stabilize and preserve present levels of salinity in the Salton Sea.

Question: Provide the Committee with a status report on the First Small Community Experiment.

Answer: The Small Community Solar Experiment Number 1 is progressing satisfactorily with verification testing scheduled during the summer of 1983. The project will determine functional and operational characteristics at the plant level in order to identify additional research and development requirements.

Decisions were made in FY 1982 to build a 100 kilowatt electric system in Osage City, Kansas. In anticipation of this project, the Department is proceeding with the development of the Rankine module under contract with Ford Aerospace and Communications Corporation through subcontracts with Barber-Nichols and Acurex. Site contracts are also planned. The Department anticipates finalizing a contract with all the participants sometime in June and expects construction to be completed 18 months from the start of the contract.

Question: Are you proceeding with the Second Small Community experiment, and how does it differ from the first?

Answer: DOE staff have recently notified Congress informally that the Department is considering deferring the funds appropriated for the Small Community Solar Experiment Number 2. Sufficient priprivate sector activity is taking place so that the experiment is no longer essential to establish the technical feasibility of advanced parabolic dish electric technology.

The Second Small Community Experiment, planned for Molokai, Hawaii, differs from the first in that it is intended to test dish systems in a much higher temperature region utilizing either Stirling or Brayton cycle technology, which would result in higher efficiencies but would require advanced high temperature materials and components.

Question: Please provide a complete list of all PV activities in FY 1983 and FY 1984 with funding levels.

Answer: For the record, I will submit the funding levels for PV activities in FY 1983 and FY 1984.

PHOTOVOLTAICS PROGRAM FUNDING
(Millions of dollars)

	Planned FY 1983	Request FY 1984
Thin Film Materials & Cell Research	11.3	11.2
High Efficiency Materials and Cell Research	8.0	9.3
Cell Theory and Validation Studies	6.3	5.7
Analysis, Testing and Reliability Studies	11.7	6.5
Silicon Materials and Cell Research	6.0	-0-
Balance of System Development	7.7	-0-
SMUD	2.0	-0-
Excimer Laser Annealing	1.0	-0-
Headquarters Activities	2.0	-0-
Other Research Activities	2.035	-0-
TOTAL	58.035	32.7

Question: Why are no funds requested in FY 1984 for technology development?

Answer: Although there is less emphasis on activities to convert research results to demonstrations, I did not mean to imply that all technology development activities have been terminated. For example, the third major element of the FY 1984 budget request includes 6.5 million dollars for "Analysis, Testing and Reliability Studies." This activity includes the collection and analysis of data from cells and modules of differing configurations, the development and implementation of accelerated lifetime testing methods for modules, and the environmental testing of new generations of modules. The data collected and analyzed from these activities will provide feedback for the design of modules with improved performance and reliability.

Wood-Burning Gas Turbines

Question: Could you tell the Committee about the Department's work in the area of wood-burning gas turbines?

ANSWER: DOE has supported research to develop wood-burning gas turbines based on the adaptation of conventional liquid fuel-fired gas turbines. Sawdust as well as pulverized wood and bark have been successfully tested in a combustor attached to a 500 h.p. gas turbine. In addition, DOE has sponsored research and development of cyclone separators which remove particulates from the combustion gases. DOE is also participating in a cost-shared project to assemble and test a wood-burning gas turbine which, when combined with a generator, will be capable of producing three megawatts of power.

Question: What applications do you foresee for this type of energy source?

ANSWER: If wood-burning gas turbines can be operated successfully they could provide either mechanical and/or electrical energy which is suited for both industrial and utility applications. One application for this energy source would be electrical power generation near sites with ready access to both wood residues and electric transmission lines. Several regions of the country possess large reserves of woody residues suitable as feedstock for power generation.

Question: What is your assessment of this technology and on what is that assessment based?

ANSWER: The proof-of-concept of a wood-burning gas turbine has been demonstrated. The next step in this development is a scale-up from 375 KW capacity to a capacity of 3,000 KW. The operation of this larger capacity machine will introduce new design considerations. Other first of a kind operational problems may be expected. However, there appears to be no insurmountable difficulties.

Question: What has the level of Federal support been over the past several years?

ANSWER: The Department of Energy has provided $1,439,868 since 1978. The U.S. Army and the U.S. Air Force have also participated.

Question: How is private industry involved?

ANSWER: A total of $3,420,000 has been committed to the program. Private industry has supported the development of the wood-burning gas turbine through cost-shared activities. Private industry participation includes Detroit Diesel Allison, a division of General Motors, Aerospace Research Corp., and Cogeneration of Tennessee, Inc.

Question: I understand that some people within DOE and the private sector feel that, with a small level of Federal support over the very near term, there would be sizable benefits and applications within the private sector. Do you concur, and if not, please explain why?

ANSWER: The wood-burning gas turbine technology is a near-term technology. The Federal R&D effort has brought this technology to a reasonable plateau of development. This effort included cooperation with industry to assemble and test a prototype system. Private industry should now assume the responsibility of near-term engineering development and the commercialization of this technology. However, efforts by Aerospace Research Corp. (the developer of wood-burning gas turbines) to obtain private sector financing have thus far failed. It may be necessary for the Department of Energy to assist in funding the operation and testing of the 3,000 KW machine.

Hearing on Renewable Energy

Question: What long term plans does the Department of Energy have to investigate the origin, nature and ultimate future resource potential of the geothermal fields of the nation?

ANSWER: The determination of the ultimate future resource potential of the geothermal fields of the Nation (i.e., national resource assessment) has been the responsibility of the Geothermal Research Program of the U.S. Geological Survey. The Department of Energy is supporting generic research and the development of improved technology to enable industry to locate, define, and develop geothermal reservoirs. Site-specific projects are supported by the Department where characterization of reservoirs is critically needed as input to the generic studies.

Question: Is the Department aware of the current thinking on the resource potential of the Imperial Valley of California and that the size of this resource may be many times larger than was thought earlier and that this potential might be tapped by the drilling of very deep wells?

ANSWER: The resource potential of the Imperial Valley of California is known to be large. This region represents the largest known water-dominated geothermal system in the Nation, with the possible exception of Yellowstone National Park. Tapping the full resource potential of the Imperial Valley may indeed require the drilling of very deep wells.

Question: What is the position of the Department with respect to collaborating with industry in high risk experiments to drill deeper into the roots of geothermal systems, to determine how deep geothermal reservoirs extend, and to release such basic scientific information to the public domain?

ANSWER: Collaboration with industry in high risk experimental work is the way we prefer to pursue our objectives. It reduces the cost to the government and ensures rapid technology transfer.

For deep drilling into the roots of geothermal systems the Department considers that collaboration with industry could provide an effective way to obtain new information on the extent of hydrothermal reservoirs and their potential for supplying larger amounts of energy than presently estimated. A cost-effective approach may be to select, in collaboration with industry, a site for a dedicated scientific hole. Such a project is being considered by the Geothermal and Hydropower Technologies Division as part of its future long-range program.

Question: Is the Department aware of the proposed Salton Sea Scientific Drilling Project? This proposal, which is receiving enthusiastic support from the scientific community, would be for an add-on experiment on a 12,000 feet deep commercial steam well being drilled into what is the hottest known geothermal field in the USA. The experiment would deepen this well to 18,000 feet, making it the deepest geothermal well in the world, and test a region of higher temperatures and pressures greater than those currently being considered by industry. Is not such a project consistent with the Department's policy of supporting high-risk basic and applied research and collaboration between industry and government?

ANSWER: We are aware of the Salton Sea Scientific Drilling Project that was proposed recently to the National Science Foundation. The general approach is attractive, but we have not had time to fully evaluate the proposal in the Department.

QUESTION SUBMITTED BY SENATOR DOMENICI

FERC Review of PMA Rates

Question: I understand that you told the House Appropriations Committee, Subcommittee on Energy and Water Development on February 24, 1983, that the Department of Energy does not intend to restrict in any way FERC's present authority to review the rates of the Power Marketing Administrations to determine if they are excessive. I interpret your statement as meaning that FERC will retain the full range of its present authority. Would you please confirm whether my understanding is correct? If not, please explain why.

Answer: Your understanding is essentially correct. In response to the concerns of the preference customers, we are considering a modification of our original proposal which will authorize FERC review of PMA rates to determine whether the revenues generated by those rates are excessive as well as whether they are adequate to achieve repayment. We are now discussing our proposal with the FERC.

QUESTIONS SUBMITED BY SENATOR INOUYE

Funding for OTEC Preliminary Design(s)

Question: Would you confirm whether it is, and will continue to be the policy of the Administration to follow the clear intent and direction of Congress to make two preliminary design awards with the money we have provided specifically for this purpose, or whether it is intended to ask for a rescission or deferral?

Answer: It is the Department's intent to carry out fully Congressional direction as it relates to the OTEC preliminary design awards. In addition, there are no plans to request rescission or deferral of funds identified for this activity.

Question: In the Administration's interpretation of the continuing resolution sent to Congress, $10 million was identified for the preliminary design phase. If the Congress makes clear its intent that all this money is to be transferred to the two cost-sharing prime contractors, and that only other ocean energy program money is to be expended on DOE support contractors to review the design work, will you follow our intent?

Answer: Both House and Senate marks differ in FY 1983 funding levels provided for the OTEC preliminary design award. The department's interpretation of the continuing resolution reflects an accommodation between the two committee reports by providing $10 million for the OTEC PON process which includes $8.5 million for preliminary design awards to two teams and $1.5 million for engineering and analysis.

QUESTIONS SUBMITED BY SENATOR KASTEN

Question: What is the status of the Superconducting Magnetic Storage project at the University of Wisconsin?

Answer: Between 1976 and 1981, the University of Wisconsin received approximately $4 million in DOE funding to develop the technology for a 1,000 MW superconducting magnetic energy storage system (SMES). The project was terminated in 1981 because of skepticism about the final utility of such a system and because of difficulties experienced in exercising management controls, particularly budget control, over the University program.

The Electric Power Research Institute (EPRI) funded an 18-month study of a 1,000 MW, 5,000 MWh SMES based on a University of Wisconsin concept, by Bechtel and G. A. Technologies Co. The final report has not been published yet, but results of the study were presented to the EPRI Program Committee on January 31, 1983. Estimated cost of such an installation, after 2 or 3 had been built, is estimated at $1.391 billion. Research and further engineering design would be needed before a much smaller unit, 100 MWh, could be built. The University of Wisconsin has submitted a proposal for 4 years of research costing approximately $15 million to find answers to the questions raised by the Bechtel-G. A. study. The Department of Energy is not planning to fund this proposal because: (1) there is considerable doubt that such a large SMES will ever be built by any utility or consortium of utilities; (2) other technologies, such as batteries, underground pumped hydro and compressed air energy storage, are much closer to fruition than EMES and can satisfy the needs of electric utilities for storage at a lower cost than SMES.

Question: What projects do you believe Congress intended to be funded by P.L. 97-377 with regard to "Physical and Chemical Storage"?

Answer: The House only stipulated that work on superconducting magnetic energy storage and hydrogen production methods should continue. We believe that what was intended with regard to superconducting magnetic energy storage is the completion of the 8 kWh unit which has been installed at the BPA Tacoma, Wash., substation. The only direction provided by the Senate is that $2.9 million be provided for the "Wisconsin Project," presumably referring to the 4-year project proposed by the University of Wisconsin.

Question: What projects do you believe Congress intended to be funded by P.L. 97-377 with regard to "Energy Storage Systems"?

Answer: In addition to the two projects listed in response to your earlier question, the House stipulated that activities on sodium/sulfur, zinc/bromine, and aluminum/air batteries should continue. There was no other direction provided by the Senate besides the "Wisconsin Project" mentioned earlier.

Question: At what levels will your office be able to fund in FY 1983 the projects listed in your answers to Questions 2 and 3?

Answer: The following list identifies planned funding levels for these projects:

(Dollars in thousands)

Project	FY 1983 funding
Superconducting Magnetic Energy Storage (BPA Tacoma)	$600
Hydrogen Production Methods	2,500
Wisconsin Project (SMES for utility storage)	0
Sodium/Sulfur Battery	3,850
Zinc/Bromine Battery	2,000
Aluminum/Air Battery	1,800

QUESTIONS SUBMITED BY SENATOR HOLLINGS

Hawaii Deep Water Cable Program

Question: In 1982 Congress appropriated $1.2 million for the Hawaii Deep Water Cable program, of which only 25% was released for an interim letter contract which was not signed until September 1982. For fiscal 1983 Congress identified $4.8 million more for this program. It is certainly the will of Congress that the Hawaii Deep Water Cable (HDWC) project should proceed.

1. Why hasn't it?

2. When will DOE get on with the signing of a definitive contract for this program?

Answer: The procurement approval package has been signed by the Assistant Secretary for Conservation and Renewable Energy and is being processed by the Procurement division. It is expected that the contract will be signed by March 18, 1983.

QUESTIONS SUBMITED BY SENATOR LAXALT

Geothermal Heating Projects, Reno, Nev.

Question: Why would the Department of Energy contemplate abandonment of this project when it is more than 75 percent complete?

Answer: The Department is currently reviewing the status of this project. Although 75 percent of the funds originally planned for this facility have been spent, the project is faced with a substantial cost overrun. In its review, the Department will consider the cost to complete the project, the amount of cost-sharing offered by the participants, the existence of similar privately funded projects, and the degree that a completed project might add to the geothermal technology base.

Question: Only a few more weeks of construction remain before the project becomes operational. Given that fact, why doesn't the Department use a portion of the fiscal year 1983 appropriation to promptly complete this project?

Answer: The reason for interrupting work on the project is to evaluate the advantages and disadvantages of an expanded Federal investment in the project, as requested by the contractor.

Question: When does the Department anticipate providing a final response to the Nevada Congressional delegation's letter about the project which was sent to Secretary Hodel on January 14?

Answer: A final response is expected on or before March 31, 1983.

SUBCOMMITTEE RECESS

Chairman HATFIELD. I appreciate very much your coming today. The committee will stand in recess until Tuesday next at 2 o'clock when we will have the Energy Department's research program.

[Whereupon, at 2:35 p.m. Thursday, March 3, the subcommittee was recessed to reconvene at 2 p.m. Tuesday, March 8.]

ENERGY AND WATER DEVELOPMENT APPROPRIATIONS FOR FISCAL YEAR 1984

TUESDAY, MARCH 8, 1983

U.S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Washington, D.C.

The subcommittee met at 2 p.m. in room SD–138 Dirksen Senate Office Building, Hon. Mark O. Hatfield (chairman) presiding.

Present: Senator Hatfield.

DEPARTMENT OF ENERGY

HIGH-ENERGY PHYSICS, BASIC RESEARCH, ENVIRONMENTAL RESEARCH, AND MAGNETIC FUSION PROGRAMS

STATEMENT OF ALVIN W. TRIVELPIECE, DIRECTOR, OFFICE OF ENERGY RESEARCH

OPENING REMARKS

Chairman HATFIELD. The hearing will come to order.

Today, we continue our hearings on the budget request for the Department of Energy and will receive testimony on energy research activities; and environment and safety programs.

First, we will hear from Dr. Alvin Trivelpiece, Director of the Office of Energy Research, followed by Dr. William A. Vaughan, Assistant Secretary for Environmental Protection, Safety and Emergency Preparedness.

PREPARED STATEMENT

On behalf of the committee, I would like to welcome you this afternoon, Dr. Trivelpiece. We will put your full statement in the record. You may proceed to summarize it or highlight it as you wish.

I believe it is about 58 pages long. I do hope you will summarize it. [Laughter.]

Dr. TRIVELPIECE. Sir, I hope so, too.

[The statement follows:]

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STATEMENT OF ALVIN W. TRIVELPIECE, DIRECTOR, OFFICE OF ENERGY RESEARCH

Mr. Chairman and Members of the Subcommittee:

I am pleased to appear before you today to discuss the FY 1984 budget request for the research programs supported by the Office of Energy Research. These programs include High Energy Physics and Nuclear Physics under the General Science and Research appropriation. Included under the Energy Supply R&D appropriation are Basic Energy Sciences, Biological and Environmental Research, Magnetic Fusion Energy, Energy Research Analyses, University Research Support, the new University Research Instrumentation program and the Multiprogram General Purpose Facilities program. It should be noted that in FY 1984, the Biological and Environmental Research (BER) program includes the Life Sciences Research and Nuclear Medicine Applications program that was formerly budgeted under the General Science appropriation. The merging of these programs recognizes the fact that there is a close interrelationship of general life sciences research to the various BER subprograms and that the BER, life sciences and nuclear medicine research efforts are managed by the same technical staff.

Let me turn now to the budget request for our programs (Table I). The total FY 1984 budget request for the programs supported by the Office of Energy Research is about $1.7 billion. Of that amount, $645.2 million falls under the General Science appropriation, with about $1.0 billion under the Energy Supply R&D appropriation. Table I summarizes the Energy Research request.

Table 1

Office of Energy Research
Summary by Program
($ in millions)

	FY 1983 Estimate	FY 1984 Request
General Sciences		
High Energy Physics	$422.2	$490.0
Nuclear Physics	130.5	153.0
General Science Program Direction	1.4	2.2
Subtotal	$554.1	$645.2
Energy Supply - R&D		
Basic Energy Sciences	$282.8	$350.2
Biological & Environmental Research	188.2	170.2
Magnetic Fusion Energy	447.1	467.0
Energy Research Analyses	2.8	2.9
University Research Support	6.0	5.5
University Research Instrumentation	0	6.0
Multiprogram General Purpose Facilities	34.0	40.6
Advisory & Oversight Program Direction	2.6	3.4
Policy and Management	1.2	0.5
Subtotal	$964.7	$1046.3
Total ER	$1518.8	$1691.5

Under General Science and Research, the FY 1984 budget request for High Energy Physics is $490.0 million. The request for Nuclear Physics is $153.0 million; and we are requesting $2.2 million for General Science Program Direction. Under Energy Supply R&D, our FY 1984 budget request includes $350.2 million for Basic Energy Sciences, $170.2 million for Biological and Environmental Research, $467.0 million for Magnetic Fusion Energy, $2.9 million for Energy Research Analyses, $5.5 million for University Research Support, $6.0 million for the new University Research Instrumentation program, and $40.6 million for Multiprogram General Purpose Facilities. Our request also included $3.4 million for Advisory and Oversight Program Direction and $0.5 million for Policy and Management.

I would like to discuss each of these programs briefly, beginning with those under the General Science and Research appropriation, and then I would be pleased to respond to questions.

HIGH ENERGY AND NUCLEAR PHYSICS

The High Energy and Nuclear Physics (HENP) programs supported by the Department fund approximately 90% of the nation's research in these fields, with the remainder supported by the National Science Foundation. These programs, which focus on experimental research using the unique facilities at DOE multiprogram laboratories, single-purpose laboratories and dedicated on-campus facilities at leading universities, have been extremely successful over the last 2-3 decades. U.S. researchers in High Energy and Nuclear Physics have won six Nobel Prizes in the last eight years and sixteen in the last 25 years. University scientists play a crucial role in these programs, conducting more than 75% of the experimental and theoretical research. The knowledge, instruments and applications that have resulted from research in these highly technological basic research areas pervade modern American society. They serve as the basis for much of our national defense strategy, for therapeutic and diagnostic medical applications, for generation of electricity with nuclear processes and for a diverse array of applications in industry and other areas of science.

The High Energy and Nuclear Physics programs are closely related in terms of goals, types of facilities and equipment used to reach those goals and the impact that research results in one program have on the other. Although the two programs do have related goals, they have quite different research emphases. Together, these programs seek a deeper understanding of the nature of matter and energy and the four basic forces of nature that interact with and cause changes in the fundamental constituents of matter. The understanding of these constituents and the physical laws governing their interactions form the basis for all of the physical sciences.

All matter that we see every day is made up of chemical elements, such as carbon, the smallest distinguishable unit of which is the atom. Within each atom there is a central core called the nucleus which contains most of the mass of the atom. The inner constituents of the atomic nucleus are protons and neutrons, which are believed to be made up of subnuclear particles called quarks. Other particles called leptons, which interact through the electromagnetic and the weak nuclear forces, also are held to be basic particles.

The Nuclear Physics program strives to attain a better understanding of the structure and properties of these atomic nuclei and the forces that govern their behavior and to determine how the quark substructure of protons and neutrons influences the make-up of nuclei (i.e., how do quarks act when they are imbedded in nuclei?). High Energy Physics research seeks to understand the nature and relationships among the four fundamental forces of nature and to understand the ultimate structure of matter in terms of the properties and interactions of its basic constituents.

Although the focus of each of the programs is somewhat different, most experiments in either the High Energy or the Nuclear Physics program depend on large particle accelerators to produce intense beams of energetic particles. These are required to probe the properties of atomic nuclei, in the case of Nuclear Physics, or to study elementary particles such as quarks and leptons and their interactions in the case of High Energy Physics. The primary experimental technique used is to study the results of collisions of high energy particles with fixed targets or with other particle beams. In these collisions, many entirely new forms of matter can be created by means of a series of energy-to-matter transformations. The study of these dynamic phenomena then reveals the properties of the underlying building blocks and basic forces involved. In general, as the particles studied become more elementary, their component parts are found to be bound together more tightly. Thus, larger, more powerful and complex accelerators, detectors and supplementary equipment are required to carry out the research.

Although progress in High Energy and Nuclear Physics is dependent on the availability of these forefront accelerator and colliding beam facilities as well as on the sophisticated detectors that record the effects of particle collisions, these advanced facilities are only one facet of the program. Progress in each of the fields of High Energy and Nuclear Physics features a continuing interplay of advancements in experiment, theory and technology. HENP experiments are done at the very forefront of theoretical and technical knowledge; and the range of experiments possible is determined by available technology. Physicists frequently have to invent unique equipment and technology to carry out the experiments of greatest importance.

In the attempt to summarize the essence of the HENP programs, it is all too easy to get lost in unfamiliar esoteric terminology. In fact, I have mentioned only a few of the hundreds of already identified or anticipated particles that inhabit the subatomic world. We have not only identified a growing number of particles, but have seen how they relate to one another and how they can be transformed during collisions with other particles in accelerator experiments. We have observed matter change into energy and vice versa; particles change into other particles which then disappear or change into still other particles. The long-standing goal of high energy physicists is to understand these diverse and complex phenomena by formulating a theory which would encompass all of the interactions of matter and energy revealed by their research. These "unified" and "grand unified" theories, as physicists call them, developed over the last 10 years, imply that the diversity existing in the universe today may have evolved from a single force, or process, that existed only when the universe was formed some 20 billion years ago.

These theories aim at linking together, or unifying, the four known fundamental forces of nature. The electromagnetic force describes how atoms and molecules are formed and is the corner-stone to understanding chemistry, electronic communications and biological processes. The weak nuclear force describes processes such as the radioactive decay of nuclei. The strong nuclear force helps describe how the nuclei of atoms can be so small and stable. The gravitational force, perhaps the most familiar of the four forces of nature, explains such things as why rocks fall and planets orbit.

Recent research results have led to an increasingly better understanding of these forces of nature. That understanding is defined in theories that indicate that the weak nuclear and the electromagnetic forces are actually different forms of a single force--referred to as the electroweak force. Two U.S. physicists shared in the 1979 Nobel Prize for work on this unification. The 1980 Nobel Prize in Physics was awarded to two U.S. physicists for work that may lead to unification of the strong nuclear and electroweak forces into what is called the grand unification theory. Eventually, it is postulated that the gravitational force will be incorporated into a super unification, thus bringing all of the basic forces into a unified framework.

In this coming year special emphasis in the High Energy Physics experimental program will be focused on testing the predictions of the currently accepted grand unified theories. Experiments will focus on further understanding the detailed properties and implications of the W particles predicted by the electroweak unified force and recently observed in Europe at CERN by a team that included U.S. physicists. CERN is the acronym for the European Organization for Nuclear Research. Experiments will also focus on effects, such as proton decay, predicted by theories that attempt to unify the strong and electroweak forces. If experiments currently underway confirm the validity of these theories, there would be a major scientific breakthrough in understanding the basic forces of nature. These new concepts may, in time, lead to an understanding of how the universe evolved from the hypothesized "big bang" to its present state and such interesting questions as whether the universe will continue to expand.

The history of progress in High Energy and Nuclear Physics research allows us to say confidently that we are moving steadily toward our long-term goal of understanding the physical world around us. But we get even more from this research. There have been many spin-offs, including the technology of superconducting materials and devices, radio frequency power generation, materials analysis and medical applications, including methods of treating cancer.

More recently, the use of synchrotron light from particle accelerators opened up totally new research capabilities in chemistry, solid state physics, biology and industrial applications. Free-electron lasers, driven by particle accelerators, promise new capabilities for enhanced laser power and control. Radiation processing of materials, which was born from this science, has many exciting new applications ranging from the manufacture of heat-shrinkable electrical insulation to the sterilization of wastes. Although we cannot predict them in advance, history has shown that these kinds of technological advancements are virtually guaranteed tangible benefits that we expect to continue to reap as a result of our investment in basic research, including High Energy and Nuclear Physics research.

HIGH ENERGY PHYSICS

Let me turn now to the FY 1984 budget request for High Energy Physics. The FY 1984 budget request of $490.0 million for High Energy Physics compares to the FY 1983 estimate of $422.2 million (Table 2). This increase of $67.8 million would permit a High Energy Physics program with an estimated utilization rate of 55% for the existing accelerators, solid support for university based experimental user groups and theoretical research efforts, continued progress on the Fermilab facility development program, and the initiation of construction on a rapid schedule of the high priority Stanford Linear Collider (SLC) project at the Stanford Linear Accelerator Center (SLAC). The Operating Expenses request for FY 1984 is $349.5 million; the Capital Equipment request is $51.5 million; and the Construction request is $89.0 million.

Table 2

High Energy Physics
Budget Authority
($ in Millions)

	FY 1983 Estimate	FY 1984 Request
Operating Expenses		
Physics Research	$ 92.2	$ 101.5
Facility Operations	152.1	166.0
High Energy Technology	76.0	82.0
	320.3	349.5
Capital Equipment	46.4	51.5
Construction	55.5	89.0
Total High Energy Physics	$ 422.2	$ 490.0

The high energy particle accelerator and colliding beam facilities that would be operated under the requested FY 1984 budget include the 30 billion electron volt (GeV) proton Alternating Gradient Synchrotron at Brookhaven National Laboratory (BNL), the 500-1000 GeV proton synchrotron at the Fermi National Accelerator Laboratory (Fermilab) and the 32 GeV linear electron accelerator at SLAC. SLAC also has two electron-positron colliding beam facilities for which the linear accelerator acts as the injector. These facilities are called SPEAR and the Positron-Electron Project (PEP). Each of the three national accelerator centers (Fermi, SLAC, BNL) provides a unique set of capabilities that complement the others. Together, they represent the experimental facilities essential for a comprehensive national research program in High Energy Physics. The major part of the High Energy Physics funding is required to meet the direct needs of these accelerator laboratories. While these three accelerators provide the experimental data sources for almost all accelerator-based High Energy Physics research in the U.S., about 75% of that research is carried out by teams of researchers from the Nation's colleges and universities. Thus, about three-quarters of the funding provided to the accelerator laboratories can be considered as indirect support of the university program.

The FY 1984 budget request for Operating Expenses of $349.5 million would provide for the first full year of operation of the Energy Saver superconducting synchrotron at Fermilab. The Energy Saver, the first stage of a multi-step development program, will reduce electric power needs and extend operation of the accelerator to 500 GeV for fixed-target experiments. With completion of early phases of the Tevatron II project, the third stage of the development program, operation at energies approaching 1000 GeV should be possible. Priority also would be given to good operation and research use of PEP, the 15 GeV x 15 GeV electron-positron colliding beam facility at SLAC. The FY 1984 Operating Expenses request would provide strong continuing support for university research groups, non-accelerator experiments and theoretical research efforts.

This FY 1984 request also includes funding for Brookhaven National Laboratory (BNL) to continue to develop accelerator-quality superconducting magnets, to develop and demonstrate techniques for fabricating the magnets reliably, and to consider lower cost magnet options. Funding is also provided to develop alternative facility designs that would use the tunnel now in existence at BNL. We anticipate a proposal from BNL at the end of March describing their new facility plans, cost and schedule estimates. DOE plans an in-depth review of the BNL proposal in April; a study of High Energy Physics facility needs will be carried out by a Subpanel of the High Energy Physics Advisory Panel (HEPAP) in June and HEPAP will review their report in July. DOE expects to make a decision in July on whether to initiate construction of a new colliding beam facility at BNL in FY 1985.

The Capital Equipment request of $51.5 million gives priority to Fermilab for equipment related to the major detector for colliding beam experiments at Tevatron I and for secondary beam line components and detectors for 1000 GeV experiments at Tevatron II, and to SLAC for work on a detector for SLC research. To accommodate these needs, other programs remain at a somewhat reduced or near constant level of effort.

The FY 1984 Construction request is for $89.0 million, an increase of $33.5 million over FY 1983 (Table 3). A major portion of this request is to initiate construction on the SLAC Linear Collider (SLC) on a rapid schedule. The goal of this project is to develop and demonstrate the practicality of using linear accelerators with precisely controlled, high intensity and highly focused beam pulses to provide high luminosity electron-positron or electron-electron collisions at energies far beyond those that will be affordable for circular colliders. Luminosity is a measure of the rate at which events can be recorded for a given process.

Completion of the SLC on a three year construction schedule will give the U.S. earliest access to copious production of a previously unidentified particle called the Z^o (pronounced zee-zero) which is a critical prediction of the electroweak force theory. Also included in the Construction request is the continuation of the Tevatron I and II projects at Fermilab. These projects comprise the second and third stages of the multi-step development program. Tevatron I permits acceleration up to 1000 GeV and will provide a facility for proton-antiproton collisions at 1000 GeV. Tevatron II will further expand the accelerator's capabilities by providing upgrading of experimental areas and beam lines external to the main ring for fixed target experiments. The remainder of the construction request is for Accelerator Improvement Projects

Table 3

High Energy Physics
Budget Authority
($ in Millions)

Construction	Prior Years	FY 1984 Request	TEC	Completion Date
Tevatron I (81-E-218)	$ 34.1	$ 20.0	$ 82.5	FY 1986
Tevatron II (82-E-206)	24.8[a/]	13.0	49.0	FY 1985
Stanford Linear Collider (84-ER-133)	2.0[b/]	40.0	112.0	FY 1986
Accelerator Improvement Projects (84-ER-131)	N/A	9.0	9.0	FY 1985
General Plant Projects (84-ER-132)	N/A	7.0	7.0	FY 1986
Total Construction		$ 89.0		

a/ Includes $800,000 for PE&D
b/ Represents $1,957,000 for PE&D

essential to maintain the reliability, efficiency and scientific effectiveness of the existing accelerator facilities and for General Plant Projects essential to the efficient and reliable operation of the laboratory sites.

NUCLEAR PHYSICS

The FY 1984 budget request for Nuclear Physics is $153.0 million, an increase of $22.5 million over the FY 1983 estimate (Table 4). Of the $153.0 million request, $128.0 million is for Operating Expenses, $11.3 million is for Capital Equipment and $13.7 million is for Construction. This budget request provides for experimental and theoretical studies aimed at improving our fundamental understanding of atomic nuclei.

Because nuclear interactions and the behavior of nuclei and nuclear matter determine the physical properties of our universe, quantitative knowledge of nuclei is essential to any basic understanding of the world about us. The Nuclear Physics program is an important element in America's long term investment in its technological future with nuclear processes. As an ancillary benefit, pursuit of Nuclear Physics program goals provides a national base of knowledge, techniques, instrumentation, and skilled manpower in critical technologies.

In addition to talented scientists, the success of the Nuclear Physics program depends upon the existence and effective operation of large and complex accelerator facilities. These facilities are the essential tools of the nuclear scientist. They provide the variety of particle beams which are required for forefront nuclear research. In FY 1984, our highest priority will be to maintain the capability of these facilities to meet evolving research requirements and to operate these facilities a sufficient number of hours in FY 1984 to meet the needs of the research program.

Table 4

Nuclear Physics
Budget Authority
($ in Millions)

	FY 1983 Estimate	FY 1984 Request
Operating Expenses		
Medium Energy Nuclear Physics	$ 52.3	$ 59.0
Heavy Ion Nuclear Physics	39.7	47.0
Low Energy Nuclear Physics	12.2	13.0
Nuclear Theory	8.2	9.0
	112.4	128.0
Capital Equipment	10.4	11.3
Construction	7.7	13.7
Total Nuclear Physics	$ 130.5	$ 153.0

In FY 1984, emphasis in the Nuclear Physics program will be given to exploitation of new research capabilities provided by successful completion of construction projects in FY 1982 and FY 1983. These capabilities include: (1) the ability to accelerate ions as heavy as uranium to low energies in the SuperHILAC and to high energies in the Bevalac (Lawrence Berkeley Laboratory); (2) the completion of the Bates Electron Accelerator recirculator project at the Massachusetts Institute of Technology (MIT) that provides electron beams for precision electron-nuclear scattering studies at higher energies than previously available; and (3) newly available heavy ion beams at the Holifield Heavy Ion Research Facility (Oak Ridge National Laboratory) and the Argonne Tandem/Linac (Argonne National Laboratory) that will allow high precision heavy ion physics studies at higher energies than previously available.

The underlying quark structure of protons and neutrons must play an important role in the makeup of nuclei. However, understanding and quantifying this role remains an important task before us. High priority experiments in FY 1984 are planned with LAMPF's (Clinton P. Anderson Meson Physics Facility at Los Alamos National Laboratory) intense pi meson beams and with Bevalac's new high energy uranium beam capability. Another important thrust in this quark substructure effort is high energy electron scattering experiments at the Stanford Linear Accelerator Center (SLAC). The FY 1984 Nuclear Physics Accelerator Improvement and Modification construction project request includes $1.65 million for a new injector at SLAC for these experiments as well as for research to understand the magnetic structure of nuclei.

Experiments which examine the weak interaction and properties of the neutrino will also be a major thrust of the FY 1984 Nuclear Physics program. The weak interaction governs beta decay of nuclei and is one of the three fundamental forces which determine the characteristics of nuclei. In FY 1984, highlights of this area of emphasis include research with polarized electron beams at Bates and with LAMPF's uniquely pure and intense muon and neutrino beams.

In FY 1984, emphasis will be given to heavy ion research with ions more massive than calcium and in the projectile energy range above 10 MeV (million electron volts) per nucleon. In particular, the newly available beams at the Holifield, the Bevalac low energy beam line, and the Argonne Tandem/Linac will be used to study the mechanisms by which colliding nuclei exchange mass, energy, and angular momentum. Above 30 MeV per nucleon, the projectiles are moving at velocities comparable with and exceeding the average internal velocity of neutrons and protons inside the individual nuclei. Collisions of target nuclei with projectile nuclei at these energies cause formation of intense concentrations of energy and mass. From these experiments, we expect to learn how nuclear matter acts as it is compressed and how energy moves through nuclear matter.

Of the $128.0 million Operating Expenses request for FY 1984, $66.3 million is needed for operation of Nuclear Physics accelerator facilities, with twelve million of this for electric power costs. This funding will allow use of facilities at the same levels as achieved in FY 1982. The remainder of the Operating Expenses request is for experimental research ($52.7 million) and theoretical research ($9.0 million).

In FY 1984, $11.3 million is requested for Capital Equipment. Of that, $10.5 million is needed to acquire experimental and computational equipment used by research scientists as well as equipment which permits effective operation of the accelerators themselves. The most important type of capital equipment needed is the detection system. New and more sophisticated detectors and analytical systems are needed to isolate the particular nuclear events that can provide new information about nuclear phenomena. The remaining $0.8 million is needed to meet Lawrence Berkeley Laboratory's laboratory-wide requirement for general purpose equipment.

The FY 1984 request for Construction funds for Nuclear Physics is $13.7 million (Table 5). The Accelerator Improvement Projects request includes $1.65 million for the new SLAC injector which I discussed earlier. This injector would produce electron beams with an intensity 100 times greater than the currents now available. The injector will permit experiments that will improve our understanding of electromagnetic properties of nuclei and of the quark structure of nuclei.

Because accelerator facilities have continuous needs during their operating lives for small modifications or additions that improve their performance and enhance their usefulnesses, the FY 1984 construction request also includes Accelerator Improvement Projects and General Plant Projects funds for such activities at the Bevalac, the Clinton P. Anderson Meson Physics Facility, and the William H. Bates Electron Linear Accelerator. The General Plant Projects request also includes funds for the laboratory-wide needs of Lawrence Berkeley Laboratory.

Table 5

Nuclear Physics
Budget Authority
($ in Millions)

Construction	FY 1984 Request	TEC	Completion Date
Univ. Accelerator Upgrade (84-ER-110)	$ 8.0	$ 19.0	FY 1987
Accelerator Improvement Projects (84-ER-121)	3.5	3.5	FY 1986
General Plant Projects (84-ER-122)	2.2	2.2	FY 1986
Total Construction	$ 13.7		

Work by university-based nuclear scientists is a prominent component of the Nuclear Physics program. University scientists conduct experiments at the national accelerator facilities and at dedicated on-campus accelerator facilities. To maintain the scientific strength and attractiveness of university-based nuclear physics facilities to students, these facilities must be maintained at scientifically competitive levels. In the FY 1984 request for Construction funds, $8.0 million is planned for upgrade of on-campus accelerator facilities at Yale University (New Haven, Connecticut) and the University of Washington (Seattle, Washington). The upgraded facilities will allow continuation of the excellent records of scientific productivity and academic preeminence of these outstanding institutions.

GENERAL SCIENCE PROGRAM DIRECTION

The FY 1984 budget request for General Science Program Direction is $2.2 million. These funds are required to provide for the salaries, benefits, travel and other expenses associated with 35 full-time equivalents in the Office of the Associate Director for High Energy and Nuclear Physics and associated support staff required to administer these programs.

I would now like to discuss the programs under the Energy Supply R&D appropriation, beginning with Basic Energy Sciences.

BASIC ENERGY SCIENCES

Although the U.S. is in much better shape today than it was 10 years ago with regard to our reliance upon foreign energy sources, there is a continuing need to expand our energy supply and conservation technology base. This is the primary role of the Basic Energy Sciences program. While the current energy situation has reduced the Department's primary focus on short-term problems, the Basic Energy Sciences role - aimed at the longer term - continues to be very important to the future of the nation. Furthermore, while the pursuit of research by Basic Energy Sciences to broaden the technology base for identified technologies continues to be important, even more important is the need for basic scientific research unconstrained by preconceived notions of which technologies will be important in the future. The Basic Energy Sciences program supports approximately 1200 research projects and provides advanced facilities that are used by university and industrial researchers as well as national laboratory scientists. Research is carried out in material sciences; chemical sciences; nuclear sciences; engineering, mathematical and geosciences; and biological energy research. An advanced energy projects effort that crosscuts all disciplines is also included.

It is difficult to convey the impact of the BES program by citing yearly research accomplishments. Scientific findings form a base of knowledge from which improvements to existing technologies or new ones evolve. Often it is only in retrospect that the true importance of research results can be assessed. However, the following examples of research results in FY 1982-1983 that have enhanced energy alternatives or improved our understanding of energy-related phenomena are illustrative of the benefits to be gained from research in the basic energy sciences.

Research in Materials Sciences has resulted in new information that:

- should improve our understanding of the useful properties of superconductivity, which may lead to advancements such as improved superconducting electrical cables important in several advanced technologies;

- will provide a better understanding of the control of stress corrosion cracking of nickel base alloys, a well-known cause of costly unscheduled outages in nuclear power plants; and

- explains the radiation swelling mechanism of a ceramic material potentially useful as a long-term storage host for nuclear waste.

Research in the Chemical Sciences subprogram has led to:

- An improved ability to measure the ratio of sulfur-32 isotope to sulfur-34 in the air. This new capability is based on negative ion mass spectrometry which allows much more sensitive measurements than the traditional positive ion mass spectrometry. This improvement is critical to establishing a reliable measurement technique that could be used to distinguish among the different kinds of sources of sulfur present in the air. Conceivably the discovery could be used in future efforts to reduce the environmental effects of coal combustion.

- Observance of a phenomenon, called "hot carrier effects", that had been theoretically predicted for semiconductor/liquid interfaces. Hot carriers are electrons or positive charges carrying excess energy that are produced by light in semiconductors. If it can be harnessed, this phenomenon could lead to a doubling in the efficiency of photoelectrochemical solar devices.

Several accomplishments under the Nuclear Sciences program relate to nuclear energy. These include:

- The fluorescence emitted from electronically excited plutonium hexafluoride (PuF_6) due to laser exposure of vapor molecules of the PuF_6 was detected for the first time. Large differences were found between PuF_6 and uranium hexafluoride. These differences will mean that process conditions (e.g., laser wavelengths, temperatures) will have to be different for separating plutonium isotopes and uranium isotopes.

- It was also found in studies of the binding of actinides to naturally occuring organic materials that migration of plutonium through soils rich in these materials would be very slow.

Work under the Engineering, Mathematical and Geosciences subprogram included:

- An applied math effort involving automated reasoning that provided a solution to the problem of showing that single component failures could not inhibit the shutdown of a nuclear reactor. This type of verification is a useful tool in nuclear plant licensing procedures.

- A geosciences effort that showed that Columbia River basalts have chemical properties that can provide a safety factor by immobilizing long-lived actinides such as neptunium.

A recent accomplishment under the Advanced Energy Projects subprogram has been demonstration of the scientific feasibility of producing storage and primary batteries with electrodes made of light polyacetylene sheets rather than lead. The successful demonstration of this concept could pave the way for a whole new technology and considerably improve the outlook for electrically-powered vehicles.

The Biological Energy Research subprogram has made progress in determining how plant systems sense temperature. It has been found that plants adapt to the environment. Control of plants' adaptive responses could lead ultimately to artifically adapting plants to specific environments, for example, for producing biomass in geographic areas where it is not now economically feasible.

At the heart of the Basic Energy Sciences program is the need for program continuity concurrent with reasonable opportunities for growth in newer, emerging areas of science. To continue its effectiveness, the BES program must: 1) maintain a strong core program -- this involves equipping, supporting and encouraging the scientists involved in our current program activities, 2) have growth opportunity to exploit new, emerging areas with great potential importance to energy and 3) continue to support existing, unique facilities while at the same time providing for needed new facilities and their operation.

Research facilities are an integral part of the overall BES program and I would like to briefly explain the progress we are making in this area. BES has recently completed construction of three important user facilities: the National Synchrotron Light Source (NSLS) at Brookhaven National Laboratory; the Intense Pulsed Neutron Source (IPNS) at Argonne National Laboratory; and the 1.5 MeV Atomic Resolution Microscope (ARM) at Lawrence Berkeley Laboratory (LBL). FY 1983 will be the first full year of operation of these new facilities. The NSLS will provide intense beams of photons in the ultraviolet and x-ray regime to enable studies of surface properties and structures not possible before. The microscope will permit examination of materials while in a corrosive environment and the IPNS can be used to investigate the fundamental vibrational modes of atoms in solids. In FY 1983 the ARM at Lawrence Berkeley Laboratory will begin operation and the National Science Foundation transfers to BES the responsibility for the operation of the Stanford Synchrotron Radiation Laboratory (SSRL), our second major research facility for synchrotron radiation. In addition, FY 1982 was the first full year of operation of the Combustion Research Facility (CRF) at Sandia National Laboratory, Livermore. This facility provides advanced and unique laser diagnostic tools to a user community consisting of scientists and engineers from academia, industry and government laboratories, all studying fundamental aspects of combustion. Among the areas investigated during the past year were aspects of soot formation, and nitrogen oxide reduction in engine exhausts. Much remains unknown in the complex and very rapid phenomena of combustion, and the advent of the CRF puts the U.S. in the scientific lead in this field.

Having briefly discussed the goals and accomplishments for the BES program, I would now like to turn my attention to the program and budget that we are requesting in FY 1984 (Tables 6 & 7). The total request for FY 1984 is $350.2 million and is composed of $295.8 million for Operating Expenses, $24.3 million for Capital Equipment and $30.1 million for Construction. The increase requested is $67.4 million above the FY 1983 level of $282.8 million and I would like to explain this increase. First, as I have mentioned earlier, we must continue to support a strong core research program including the National laboratories, universities, and industrial communities. Secondly, we must expand and fully utilize equipment and facilities to, at a minimum, keep pace with international competition and our own needs. Finally, we must exploit new research opportunities that appear to hold promise of significant breakthroughs important to energy. The budget that we are requesting for FY 1984 will accomplish these goals.

The principal components of the increases sought above for FY 1983 are:

- o First, the FY 1984 budget request provides for a cost of living allowance of $15.4 million and allows a modest $8.9 million growth in the various subprograms in the most promising new research areas. Included are the funds

Table 6

BASIC ENERGY SCIENCES
Budget Authority
($ in millions)

	FY 1983 Estimate	FY 1984 Request
Operating Expenses		
Nuclear Sciences	$ 30.6	$ 37.9
Materials Sciences	108.7	125.1
Chemical Sciences	70.0	75.5
Engineering, Mathematical and Geosciences	31.1	33.7
Advanced Energy Projects	8.3	9.1
Biological Energy Research	9.5	10.6
Program Direction	3.1	3.9
	261.3	295.8
Capital Equipment	18.1	24.3
Construction	3.4	30.1
Total Basic Energy Sciences	$ 282.8	$ 350.2

Table 7

BASIC ENERGY SCIENCES
Budget Authority
($ in millions)

	Prior Years	FY 1984 Request	TEC	Completion Date
NSLS Beam Lines and Support Area Construction, BNL	0	$ 2.5	$19.7	FY 1986
National Center for Advanced Materials, LBL	0	25.9	138.9	FY 1989
Accelerator Improvement Projects	N/A	1.3	1.3	FY 1985
General Plant Projects	N/A	0.4	0.4	FY 1985
Total		$30.1		

needed to meet increased costs for facility operations, and for equipment replacements and additions, as well as for program direction.

- o Second, the FY 1984 budget provides for an Advanced Materials Research initiative of $38.0 million which includes two major construction projects and directly related research and equipment. The new construction projects are the National Center for Advanced Materials at LBL and an expansion of capability at the National Synchrotron Light Source at Brookhaven National Laboratory.

In addition, the FY 1984 budget request includes an increment of $5.0 million for Heavy Ion Fusion Research, a program transferred to Basic Energy Sciences from the Office of Inertial Fusion, Defense Programs.

The first item which I mentioned is fairly straightforward but I would like to spend some time discussing the materials initiative and the transfer to BES of the Heavy Ion Fusion program. The Advanced Materials Research initiative builds on the base of knowledge established by the Materials Sciences program. It will complement ongoing core program activities. It will also help maintain U.S. leadership in the field of materials sciences. Research in materials sciences contributes to developing new or substitute materials, tailoring materials for specific applications, predicting materials problems and service life, and improving our ability to deal with unforeseen materials problems in advanced energy systems. Additional research is required to answer a myriad of materials-related questions and is recommended in a series of studies performed by leaders in the scientific community. This initiative takes a substantial step in meeting the existing and projected needs for new work in surface science and catalysis, materials preparation and characterization, and the concepts behind materials as they are used in devices, both large and small.

Of the $38.0 million request for the materials initiative, $7.7 million is for Operating Expenses, $1.9 million is for Capital Equipment and $28.4 million is for Construction. The total TEC for the initiative is $138.9 million. Included in the Construction request would be a National Center for Advanced Materials (NCAM) composed of four new facilities and improvements at the SSRL ($25.9 million). The new facilities would include an Advanced Light Source and Surface Science and Catalysis Laboratory, an Advanced Materials Synthesis Laboratory and an Advanced Device Concepts Laboratory. Also included in the materials initiative is an expanded capability at the National Synchrotron Light Source ($2.5 million).

The Advanced Materials Research initiative will be organized to include participation by U.S. industry as well as universities and laboratories. Industry will participate in the design and use of the facilities to assure that the research addresses appropriate high-technology needs. For example, at the National Center for Advanced Materials (NCAM), an advisory board composed of scientific leaders from industry, universities, and laboratories will advise the LBL director on NCAM scientific program directions. The NSLS and SSRL already have active industrial participants and advisory groups that effectively interact with the scientific community at large. These new facilities and the involvement of industry will provide otherwise unavailable research capabilities that will improve on the U.S. competitive position in high-technology over the long term.

In FY 1984, the Heavy Ion Fusion Research program will be transferred from the Office of Inertial Fusion, Defense Programs to the Office of Energy Research. Within ER, it will be located under the BES Nuclear Sciences subprogram. The program has been moved in response to Congressional guidance contained in Conference Report 97-342 on the Authorization Act for DOE national security programs for 1982. The guidance stated that heavy ion fusion research which is directed toward development of new energy sources should not be funded from the defense inertial confinement program. The goal of the Heavy Ion Research program is to develop heavy ion accelerator technology and perform appropriate ion beam experiments to develop an adequate data base for evaluation of heavy ion inertial fusion drivers and their possible use in civilian power applications of inertial confinement fusion.

I will now describe the Biological and Environmental Research program.

BIOLOGICAL AND ENVIRONMENTAL RESEARCH

The effects of new and existing sources of energy on human health and the environment are concerns shared by the whole country. The Biological and Environmental Research (BER) program is the only long-term, multidisciplinary research effort in the Federal Government specifically devoted to the range of environmental and health issues that we are likely to face in expanding existing energy technologies, or developing new energy sources. The goals of this research are to identify, before a technology is locked into place, the early and late effects, if any, on human health and the environment. Answers to these questions, if obtained early enough, will permit energy requirements to be met with minimum damage to human health and the environment. In addition, these answers will prevent the expenses associated with unnecessarily restrictive regulations and delays in deploying the technology.

This research program began 35 years ago to look at ways of measuring radiation, understanding the major processes that move radionuclides back through the environment to man, and how radiation affects human health. Now, a number of years later, it is apparent that many of the same biological questions that have been studied in radiation-related research must also be answered with respect to the effects of energy-related chemicals on human health (e.g., what is the impact on mutation rates and cancer incidence, on reproductive functions and on critical organ systems like the lungs and bone marrow). Many of the same processes in the environment, the same interactions at the cellular level, and the same types of damage to DNA and other cell components are characteristic of other energy-related pollutants as well.

In addition to improving our understanding of the effects of radiation on man and the environment, one of the major accomplishments of this research program is the reduction in human pain and suffering that results from advances made in the Nuclear Medicine program. These advances have greatly reduced the need for exploratory surgery. Using isotopes and advanced imaging equipment developed by our contractors, doctors can treat diseases and examine a beating heart or a functioning brain to detect problems, if they exist, before they become life threatening. The ideas and inventions developed in this program have been transferred to and commercialized by industry and are used in hospitals throughout the world.

Much progress has been made in understanding the health and environmental issues associated with energy technology developments, but more research is needed. Since most of the questions which need to be addressed are generic in nature, the BER program will focus on the long-term, basic and applied research needed to resolve these issues. The FY 1984 budget request for Biological and Environmental Research is $170.2 million, a decrease of $18.0 million. Of this amount, $161.5 million is for Operating Expenses, $7.7 million is for Capital Equipment, and $1.0 million is for construction (Table 8).

In FY 1984 the BER program includes the Life Sciences Research and Nuclear Medicine Applications programs formerly budgeted under the General Science and Research appropriation. The merging of these programs recognizes the fact that there is a close interrelationship of general life sciences research with the various subprograms of BER and that both programs, as well as the Nuclear Medicine Applications research effort, are managed by the same technical staff.

The level of funding requested in this budget will allow us to continue to obtain new data needed by the Department and the Nation to allow us to make program and policy decisions that will ensure effective and environmentally acceptable use of the present and future energy options and safe conduct of national security activities. To obtain the data needed to address health and

Table 8

Biological and Environmental Research
(B/A in millions)

	FY 1983	FY 1984
Operating Expenses	$174.2	$161.5
Capital Equipment	12.0	7.7
Construction	2.0	1.0
Total	$188.2	$170.2

environmental issues, a multidisciplinary research effort is needed. Therefore, the Biological and Environmental Research program is organized and managed by discipline. These disciplines, or subprograms, include Human Health Research, Health Effects Research, Environmental Research, Physical and Technological Research and Nuclear Medicine Applications. Funding by various subprograms is shown in Table 9. I would like to take a moment now to summarize the FY 1984 budget request in each of these areas including the Carbon Dioxide subprogram which is budgeted in the BER program but managed under the Basic Energy Sciences program.

Human Health Research

The principal objective of the Human Health Research subprogram, for which $24.4 million is requested in FY 1984, is to determine whether exposure of humans to agents associated with atomic energy defense activities and energy production and use results in such health effects as cancer and genetic defects. Since these diseases do not manifest themselves until years after exposure, long-term epidemiological studies of relatively large numbers of exposed and control individuals must be followed to determine whether correlations between radiation exposure and disease incidences actually exist. Nearly two-thirds of this subprogram budget is "mortgaged" for studies of over one million individuals who have been exposed to radiation. In these investigations we are studying the Japanese A-bomb survivors, and U.S. workers from nuclear shipyards, uranium mines, reactor operations and the now defunct radium watch dial industry. These studies continue to yield important data on the

Table 9

Biological and Environmental Research
(B/A in millions)

	FY 1983	FY 1984
Human Health Research	$ 25.8	$ 24.4
Health Effects Research in Biological Systems	58.5	51.9
Environmental Research	25.6	22.6
Physical & Technological Research	29.3	26.0
Health & Environmental Risk Analysis	1.7	0
Nuclear Medicine Applications	21.0	21.0
Program Direction	3.3	3.6
Subtotal Operating Expenses	$165.2	$149.5
Capital Equipment	12.0	7.7
Construction	2.0	1.0
Total BER/OHER	$179.2	$158.2
Carbon Dioxide Research	9.0	12.0
Total Biological and Environmental Research	$188.2	$170.2

radiation-induced effects in humans who have been exposed to both external radiation and internally deposited radionuclides. The FY 1984 budget request would provide for improvements in the precision of our studies of nuclear workers, and would continue the current program at a level that will ensure that useful results are obtained in a timely manner.

Although the major emphasis of the program has been on health effects from radiation exposure, in recent years the human health research program has been expanded modestly to include selected, small scale research efforts on populations of individuals who have been exposed to chemicals from nonnuclear energy technology sources and conservation options. This nonnuclear research will continue at a reduced level.

Health Effects Research

Ideally, human health risks should be estimated from data obtained in studies of human responses to toxic agents. However, it is not possible to experiment with humans, and existing human data are rarely adequate for making reliable health-risk estimates. Therefore, epidemiological data must be supplemented with information from studies of animals and other living systems. Research in the Health Effects Research subprogram, for which $51.9 million is requested in FY 1984, is providing data which can be used to quantify dose-response relationships in experimental animal systems. In addition, experimental animals, as well as molecular and cellular systems, are being used to study how physical and chemical toxicants induce health effects and to evaluate the many variables (e.g., level, rate and route of exposure) that may affect how humans respond to harmful environmental agents.

Information obtained in these experimental systems permits one to establish the fundamental concepts and scientific data base needed to confirm or improve predictions of health impacts in exposed human populations. Emphasis in the program, which often requires unique experimental facilities, is placed on determining the delayed biological effects that are induced by repeated or chronic exposures to low concentrations of toxic agents. Three categories of health effects are investigated: cancer, genetic damage, and toxicity to functional systems of the body.

In the radiation area, research continues to develop quantitative information on the cancer risks associated with exposures to low-doses of radiation from external radiation sources and from radionuclides deposited in body tissues. Of major importance are a series of ongoing lifetime studies with dogs exposed to plutonium, other transuranic elements and long-lived fission products by inhalation, ingestion, or injection.

Since there is no data base available on the biological effects produced in humans following exposure to neutrons, research also is being conducted at several DOE laboratories to investigate mechanisms of neutron-induced cancer in experimental animals and in mammalian cell systems. Recent data obtained at the Argonne National Laboratory JANUS reactor have demonstrated that long-term repetitive low doses of neutrons produce more tumors and more cell transformations than occur when the equivalent total neutron dose is delivered over a shorter period of time. Because of the importance of these data for estimates of risk to workers at nuclear facilities, including power and weapon fabrication plants, emphasis in FY 1984 will be directed to obtaining more quantitative information as well as data on the mechanisms involved in this enhanced neutron effect.

Our research also addresses health issues related to the production and use of America's vast fossil reserves. The products, byproducts, emissions and process streams of synthetic fuel processes contain thousands of chemical compounds whose health effects are unknown. Because of the complexity of these mixtures, new methods were needed to identify those compounds that might adversely affect living organisms, and to study the nature of these effects. Accordingly, reliable short-term tests, including the well known Ames test, were developed to identify those chemicals capable of causing genetic damage or cancer.

As a result of recent short-term research, we now have a much better understanding of the potentially hazardous chemical compounds involved in synfuel processes. In summary, we now know that relatively few compounds out of the thousands present in complex synfuel materials are biologically toxic and that these same components appear to be responsible for the toxicity of synfuel materials regardless of the process used to produce the fuel. On the basis of this knowledge, we can now focus our longer-term research efforts on fewer, more generic questions. It is our intent to conduct research on (1) the genetic and late biological effects produced by representative energy-related chemicals about which little or nothing is known, (2) the fundamental mechanisms involved in initiation, promotion and inhibition of cancer expression, and (3) the biological effects produced by these complex mixtures of chemicals, since most individuals will be exposed to complex mixtures, rather than individual compounds.

Basic molecular and cellular research also will continue to use powerful new biophysical and genetic research tools as probes to improve insights into the structure, properties, and functions of cell proteins, nucleic acids, and other cell constituents that are targets of both physical and chemical pollutant action.

Environmental Research

The FY 1984 budget request for the Environmental Research subprogram is $22.6 million. This request would continue to support the Department's basic environmental research program. Through Environmental Research we are learning about the mechanisms that control and influence total ecosystems and the critical elements within them so that we can conduct defense activities and site and operate energy systems in a cost-effective, environmentally safe manner.

To obtain this information base, an interdisciplinary research program in terrestrial and aquatic systems is conducted in different climatic regions and in offshore regions along the east and west coasts of the U.S. This research is designed to: (1) identify how energy and weapons-related materials are transported through and changed in the environment; (2) determine effects of defense and energy activities on critical ecosystems and the resiliency of these systems to continued stress; (3) manipulate damaged ecosystems to determine the most beneficial methods of recovery; and (4) identify processes used by plants and animals in degrading and detoxifying pollutants in the environment.

To accomplish these tasks, the program investigates the cycling of natural, defense and energy-related materials through land and marine environments as well as the way that biological systems respond to stress. In cycling research, inorganic and organic compounds and radionuclides are identified as they move and change form through water bodies, soils, and sediments. Availability of these materials to plants and animals is determined, including studies on plant uptake through roots and leaves, thus incorporating the materials into the food chain. Studies on cycling of contaminants are coupled to studies on cycling of nutrients normally required by an ecosystem; this provides important information needed to develop scientifically sound measures for control of materials. For example, where a radioelement behaves like a plant and animal nutrient, it may be concentrated in certain food chains. Recent research results indicate that technetium, a radioactive fission product, behaves like sulfur and accumulates in plants, fowl, and ultimately in eggs consumed by humans.

Investigations on biological responses of ecosystems are carried out on communities of plants and animals, and populations of single species, and on single cells of plants and animals. This long-term research paid off when it was used recently to develop master maps showing different sensitivities of environmental units in the Arctic. Based on information on the maps, user groups can predict the ability of each landscape unit to handle stresses resulting from increased vehicle traffic, oil spills, or construction.

Long-term safe storage and disposal of contaminants from the extraction, refining, or combustion of fuels is a pressing problem, particularly in energy-rich regions of the country. An expansion of this basic portion of our program on cycling of materials in terrestrial systems will be made in FY 1984. It will focus on movement and fate of chemicals dissolved by water percolating through the ground, including the role of vegetation for sequestering possible contaminants in these waters. We will focus research on understanding metabolic processes which accumulate or eliminate metals in plants and animals.

Physical and Technological Research

This subprogram, for which $26.0 million is requested in FY 1984, constitutes the physical sciences component of the health and environmental research program. Analytical chemistry research under this subprogram identifies and measures chemical classes and compounds that cause biological activity in defense and energy-related materials. This subprogram also includes atmospheric science research aimed at improving our capability to describe how materials move through and are changed in the atmosphere. Finally, the measurement sciences activity develops improved radiation and chemical instrumentation systems as well as better techniques for assessing human exposure to defense and energy-related agents.

A key activity over the past few years has been to characterize chemically a variety of synfuels-related materials to determine which specific chemicals are responsible for producing biological effects in simple test systems. Through this research we have learned that the same types of chemicals are responsible for biological activity found in coal derived syncrudes and boiler fuels as well as gasifier tars. With this knowledge, we can confidently complete our chemical analyses effort in conjunction with short-term biological studies and in FY 1984 realign our research program to address long-term generic issues relevant to all coal conversion technologies.

In the atmospheric sciences area, research on acid deposition has produced the first comprehensive description of the distribution of major chemical species over the North American Continent. These descriptions display seasonal concentrations of calcium, ammonium, nitrate, sulfate, and hydrogen ions and show greatest deposition in the Ohio, Pennsylvania, West Virginia region. In addition, a series of models have been developed that predict spatial and temporal concentrations of various chemicals from power plants. These models will be tested to evaluate their capability and determine their limitations.

Another atmospheric science activity involves the study of long-range transport. Many regional air pollution models have been developed in the last few years, but until recently, there has been no way to verify them. The development of a series of non-reacting non-depositing gaseous tracers, the perfluorocarbons, which can be detected down to 2 parts in 10^{15} parts of air, now enables verification of model transport predictions over areas as large as the Northeastern United States.

The first full field experiments will take place later this summer during which six releases of the tracers from western Ohio and possibly Central Ontario will be measured at about 100 surface locations in the northeastern U.S. and Southern California. Aircraft will also be used to measure the tracer in the atmosphere. Since the tracer released from either of the two locations will travel over the Appalachian mountains, the experiment, which will continue in FY 1984, is called the Cross-Appalachian Tracer Experiment-1983 (CAPTEX-83). For the overall atmospheric dispersion question, this experiment is designed to separate the physical transport component from the chemical transformation component, and will enable a definitive evaluation of physical transport models.

Sponsoring CAPTEX-83 along with the Department of Energy are the National Oceanic and Atmospheric Administration, The Environmental Protection Agency, the Electric Power Research Institute, the Atmospheric Environment Service of Canada and the Provinces of Ontario and Quebec.

Nuclear Medicine Applications

Nuclear Medicine is the branch of medicine concerned with the use of radioactive and stable isotopes in biomedical research and clinical medicine. The Department fosters research in nuclear medicine by bringing together physicists, chemists, biologists, engineers and physicians to develop medically useful isotopes, isotope-labeled pharmaceuticals and instrumentation to the level where their clinical feasibility is established. Thereafter, these new technologies, instruments, and isotopic materials are taken over by the private sector for manufacture and distribution or by other agencies or institutions to be used for the study of specific diseases.

The development and application of nuclear techniques for diagnostic purposes has changed the practice of medicine. They have reduced the need for invasive procedures and exploratory surgery, made hospital stays shorter, less painful and less dangerous and have greatly expanded the physicians' arsenal in this fight against disease and human suffering. Our Nuclear Medicine Applications program, for which $21.0 million is requested in FY 1984, has played an important role in these developments and continues to do so.

Recently there has been much research emphasis on the production and diagnostic use of short-lived radionuclides. Medically these isotopes are useful because they decrease the dose of radiation to the patient. Other aspects are also important. For example, a collaborative effort between Oak Ridge National Laboratory and Children's Hospital in Boston is nearing the completion of an Osmium-191/Iridium-191m generator. Osmium-191 with a half life of 15.4 days produces a daughter, Iridium-191m, which has a half life of only 4.96 seconds. This allows tests to be repeated and validated rapidly with practically no radiation to the patient. Even more important, there is now perhaps a good non-invasive way to diagnose accurately suspected congenital heart problems in infants and children.

Concurrent with the development of short-lived radionuclides has been the growth of Positron Emission Tomography (PET), an imaging device. It provides an unprecedented capability to examine and measure the local biochemical and physiologic changes of the human body. The combination of computer based tomographic techniques and radiolabeled natural chemicals permits PET to be used as a safe, non-invasive biochemical microscope. The physician can look inside the human body and examine the life sustaining processes of body chemistry.

Research is also being conducted to develop neutron capture therapy for potential use in medicine. This type of treatment requires the incorporation of compounds labeled with boron into the tumor, and subsequent irradiation with neutrons. The boron atoms capture the neutrons, and in so doing, emit alpha particles which are extremely effective in killing nearby cells. Thus, the radiation dose is almost all concentrated in the tumor, producing no damage to surrounding healthy tissue. Recent developments in both boron chemistry and in our ability to develop cancer-seeking compounds have revived our interest in this method of treatment.

Carbon Dioxide Research

The Carbon Dioxide Research program is designed to develop a sound, quantitative atmospheric carbon dioxide knowledge base to aid in energy policy decision making. While funds for this CO_2 program are budgeted in the Biological and Environmental Research

Program, the Office of Basic Energy Sciences manages the CO_2 program.

We must improve our understanding of the fundamental scientific relationships between CO_2 concentration and climate; this can only be accomplished by increased data collection, improved measurements, and development of reliable models. We can then answer questions with confidence about the relationships between future atmospheric levels of carbon dioxide, the magnitude of climate change and the responses of crops and ecosystems to higher CO_2 levels.

The FY 1984 budget request of $12.0 million will place additional programmatic effort on collecting and analyzing data on the effects of increased CO_2 levels on crops such as corn and wheat; expanding our research efforts on the first detection of CO_2 induced climate change; increasing research on carbon uptake in oceans; and participating in an international cloud climatology program that should significantly improve climate models.

The next program that I will discuss is the Magnetic Fusion Energy Program.

MAGNETIC FUSION ENERGY

The Department of Energy manages the Government's program that seeks to demonstrate the scientific and engineering feasibility of nuclear fusion. The Department's policy on fusion is to maintain a leadership role for the U.S. in the area of magnetic fusion energy research and development. This is being done by conducting a program of research involving various fusion plasma confinement concepts. During the next decade, it is expected that one of these plasma confinement concepts will be selected for further development as a power system. The Department also plans to develop the magnetic fusion energy technological base and transfer it to industry.

The goal of the Magnetic Fusion Energy Program is to develop the scientific and technological information required to design and construct magnetic fusion power systems. These systems should provide an effectively inexhaustible, environmentally and economically acceptable energy source for the future. The program is based on the fact that light nuclei such as deuterium and tritium will undergo nuclear fusion when they are caused to collide with each other at high speeds. This fusion reaction releases more energy than is associated with the speed of the colliding nuclei. To cause the controlled release of enough such energy to make a practical power system requires the creation and confinement of a hot ionized gas (plasma) at temperatures in excess of 100,000,000 degrees Celsius.

During the past three decades, the program has focused on the basic scientific and technological issues associated with the production, heating and confinement of high temperature plasmas in various magnetic field configurations. This phase of the program is entering its final period with the completion of the Tokamak Fusion Test Reactor (TFTR) facility at the Princeton Plasma Physics Laboratory. TFTR is designed to demonstrate the scientific feasibility of magnetic fusion energy release. The experimental program leading to this demonstration is expected to achieve energy breakeven by about 1986, i.e., the generation by fusion of as much energy as was required to heat the plasma. The TFTR attained its first plasma in December, 1982.

During the next decade, the program will emphasize the applied scientific research and technology development needed to produce practical fusion applications. Research efforts will concentrate on the two leading plasma confinement approaches, the long pulse tokamak concept and the tandem mirror concept, in parallel with associated engineering and development. It is expected that this effort will lead to the selection of one of the major concepts for use as the fusion plasma core of an advanced engineering development device needed for a full demonstration of engineering feasibility.

The Department's plan for developing fusion energy involves a three-phase program. The first phase will emphasize achieving scientific feasibility in the next few years. The second, or Product Definition phase, will concentrate on the selection of a reactor concept for further advanced engineering and technology development. The Product Definition phase will also include the design of an Engineering Test Reactor (ETR) aimed at demonstrating the engineering feasibility of fusion. The third, or Product Development phase, will involve the development of the data base needed for the commercial application of fusion power reactors.

The U.S. fusion program continues to make significant scientific progress. Presently, the tokamak is the most developed confinement concept followed by the more recently developed tandem mirror. Both are ready to attempt production of reactor-grade plasmas through the existing Tokamak Fusion Test Reactor (TFTR) and the Mirror Fusion Test Facility (MFTF-B), which is under construction at Lawrence Livermore National Laboratory. Several of the currently operating tokamak experiments have, in separate experiments, achieved reactor-level temperatures and near reactor-level confinement times and densities. TFTR and its possible upgrades will use deuterium and tritium fuel to provide an introduction to the physics and engineering problems likely to be encountered in a power-producing reactor.

In the mirror program, reactor level temperatures have already been achieved. The Tandem Mirror Experiment (TMX), also at Lawrence Livermore National Laboratory, has established the basic principles of the tandem mirror concept without thermal barriers. The TMX upgrade (TMX-U) will be the primary mirror device operating in 1983. In TMX-U the key scientific issues of the thermal barrier concept will be investigated. Thermal barriers are produced with microwave heating and neutral beam pumping to improve the operating performance of the tandem mirror by allowing hotter plasmas to be confined for a longer time and improving the plasma stability. Construction of the MFTF-B project is scheduled for completion in 1987. This device will investigate the physics and engineering principles of reactor-level tandem mirrors in much the same way that TFTR will do for the tokamak design. It is expected that plasma conditions approaching the equivalent of energy breakeven should be obtained using hydrogen and deuterium.

Experience with near reactor size components, such as superconducting magnets and plasma heating systems, will also be obtained in these experiments.

In the advanced fusion concepts program, both the compact toroid experiments, conducted by laboratory, university and industrial entities, and the ZT-40 reversed field pinch experiment, at Los Alamos National Laboratory, achieved significantly longer plasma lifetime and higher temperature this year. In addition, a new process has been identified in these experiments, which may lead to much longer plasma duration than had previously been expected.

The fusion technology development program supports engineering research and development needed for practical fusion energy systems. The program has developed components and subsystems for ongoing experiments and is now working on critical components and technologies for next generation devices. Perhaps the best examples of work in the latter area are the development and testing of large superconducting magnets in the Large Coil Test Facility at Oak Ridge National Laboratory and demonstration of tritium handling technology in the Tritium Systems Test Assembly at Los Alamos National Laboratory. Some of the technology developed for these fusion programs, will undoubtedly find broader application.

Let me turn now to the details of the Magnetic Fusion Energy budget request. The President's request for FY 1984 is $467 million, an increase of $19.9 million over the FY 1983 estimate. The FY 1984 request includes $392.7 million for Operating Expenses, $37.8 million for Capital Equipment and $36.5 million for Construction (Tables 10 & 11). The FY 1984 request will support the scientific and technological development of the two mainline concepts, tokamaks and tandem mirrors, as well as further work on alternate concepts.

The Magnetic Fusion Energy budget request is shown by subprogram in Table 12. This proposed allocation of the total fusion budget will allow the program to conduct a balanced R&D effort focused on defining a practical fusion product for further development. As

Table 10

Magnetic Fusion Energy
Budget Authority
($ in Millions)

	FY 1983 Estimate	FY 1984 Request
Operating Expenses	$ 361.6	$ 392.7
Capital Equipment	39.5	37.8
Construction	46.0	36.5
Total	$ 447.1	$ 467.0

Table 11

Office of Energy Research
FY 1984
Magnetic Fusion Energy
(B/A in Millions)

	FY 1983 Estimate	FY 1984 Request
Operating Expenses		
Applied Plasma Physics	$ 73.3	$ 76.0
Toroidal Confinement Systems	137.7	144.1
Mirror Confinement Systems	43.3	41.9
Development and Technology	74.3	77.4
Planning and Projects	29.0	48.7
Program Direction	4.0	4.6
Subtotal	$361.6	$392.7
Capital Equipment	39.5	37.8
Construction		
Mirror Fusion Test Facility-B	40.0	30.0
General Plant Projects	6.0	6.5
Subtotal	$ 46.0	$ 36.5
Total	$447.1	$467.0

can be seen from this table the most significant change from FY 1983 is in the Planning and Projects subprogram where resources are needed for the fabrication of auxiliary components for the MFTF-B project. The other significant change proposed in the FY 1984 budget request is the termination of effort on the Elmo Bumpy Torus Proof-of-Principle project at Oak Ridge National Laboratory.

Table 12

Magnetic Fusion Energy
FY 1984 Budget
Total Program Request
($ in millions; B/A)

	FY 1982	FY 1983	FY 1984
Applied Plasma Physics	72.9	77.3	81.1
Confinement Systems	155.4	202.8	206.7
Development and Technology	88.7	84.0	85.1
Planning and Projects	130.6	79.0	89.5
Program Direction	3.6	4.0	4.6
Total	451.2	447.1	467.0

The FY 1984 budget request for Confinement Systems of $206.7 million would be directed at improved plasma performance and tests of critical plasma issues: higher temperatures, longer confinement time, higher magnetic efficiency, steady state plasma discharges and improved impurity controls.

The Toroidal Confinement Systems category budget will increase to $159.7 million. This will allow physics experiments to continue as planned on the Princeton Large Torus, Alcator C (Massachusetts Institute of Technology) and Doublet III (GA Technologies, Inc., La Jolla, California). The Poloidal Diverter Experiment (PDX) facility at Princeton will be shut down by the end of FY 1983 and the Impurities Studies Experiment (ISX-B) at Oak Ridge National Laboratory will be operated until the completion of its planned experiments for FY 1984. While no new device fabrication projects are proposed, several will continue in FY 1984 including the provision of a new D-shaped vacuum vessel and additional electron cyclotron resonance heating power on Doublet III and the modification of the Princeton Large Torus facility for steady-state experiments. TFTR would be funded at the FY 1983 level for the first full year of experimental operations. While some preliminary information will be obtained from TFTR in FY 1983, higher power operation will not begin until FY 1984 when the the first two neutral beam systems will be installed.

A total of $47 million of the Confinement Systems request will support the Mirror Confinement Systems budget category including both the mainline tandem mirror program and the Elmo Bumpy Torus (EBT) alternate concept program. Both of these areas are aimed at producing a steady-state source of fusion power. The primary technical difference between these two mirror-based concepts is that the tandem mirror is a linear, open-ended system, while the bumpy torus is a toroidal closed system, but one which consists of many small mirror cells, linked together in series.

Of the several tandem mirror devices currently operating, TMX-U is the "workhorse" facility of the program, with large heating capability using microwaves and neutral beams. A facility called TARA, now being fabricated at the Massachusetts Institute of Technology, will provide a major test of axisymmetric design, the favored reactor approach for the thermal barrier tandem mirror. The TARA construction will be completed in FY 1984; funds also are provided to initiate experimental operations in FY 1984. Together these two machines (TMX-U and TARA) will provide proof-of-principle demonstrations of the key physics issues for thermal barrier tandem mirrors in the period FY 1983-1985. Supporting research efforts will continue to be provided from the operation of several smaller devices.

The EBT-S facility at Oak Ridge National Laboratory is the only operating bumpy torus device in the U.S.; it provides the experimental physics data in this country for this concept. A base scientific program will be maintained on this alternate concept using the EBT-S facility in FY 1984; however, a decision has been made to terminate the EBT-P proof-of-principle project in FY 1984. This decision is based on technical priorities within the overall budget.

The Confinement Systems subprogram, in conjunction with the Applied Plasma Physics (APP) subprogram, provides the physics basis for the fusion program. The budget request of $81.1 million for APP will allow continued support of these efforts. Theoretical programs in the APP subprogram seek to interpret and predict the results of confinement experiments and use this understanding for the design of improved experiments and reactors. Small experiments, a large portion of which are carried out at universities, will investigate specific issues of tokamak or mirror physics and also develop advanced diagnostic techniques for use in confinement experiments. APP experiments will also investigate concept improvements leading to potential compact reactor configurations such as reversed field pinches or compact toroids. These efforts also help provide a more complete understanding of the physics and technology data base for magnetic fusion. The final activity supported under this subprogram is the operation and maintenance of the MFE computer network. This integrated network provides for all the scientific and engineering computing needs for the entire fusion program and is operated via a satellite communications system.

The FY 1984 budget request for the Development and Technology (D&T) subprogram is $85.1 million. The goals of this subprogram are to (1) provide technology support to the major existing confinement devices; (2) to develop the critical engineering and technological basis needed for the selection of the best confinement and technology options for the fusion reactor plasma core decision and the Engineering Test Reactor decision; and (3) to support key long-term requirements for developing commercial fusion. As a result of the present strategy for fusion development, D&T efforts in FY 1984 will emphasize high priority work that supports reactor concept selection and technology feasibility questions. In carrying out these tasks, one of our objectives is to obtain significant participation by industry in fusion technology development to build the base that will be needed in order for fusion to be used commercially. The proposed funding level provides for continued development in the areas of magnets, heating technology, materials, and system components.

The Planning and Projects subprogram, with an FY 1984 request of $89.5 million, is responsible for constructing major new facilities and conducting project specific research and development activities. General Plant Projects (GPP) and General Purpose Equipment (GPE) are also funded in this category. The major effort in FY 1984 is associated with construction of the MFTF-B project and fabrication of auxiliary components for this facility. Funding is also provided for continuation of the TFTR flexibility modifications to enable us to understand self heating of the plasma as a result of burning deuterium and tritium. The Fusion Materials Irradiation Test facility (FMIT) at the Hanford Engineering Development Laboratory will allow materials testing in an environment representative of an operating fusion reactor. It will also provide neutron fluxes several times that of a fusion reactor to allow accelerated end of life testing of fusion system materials. Although funding in the FY 1984 budget is provided to maintain essential FMIT activities, completion of the accelerator development in FY 1984 will depend on the international cooperation on the FMIT project.

International cooperation by various components of the U.S. fusion program has increased significantly during recent years. The major foreign partners are the European community and Japan, with selected scientific exchanges with the Soviet Union as well. Those cooperative activities include: sharing of research data, joint planning of comprehensive research programs in selected areas, joint funding of multi-million dollar projects in the U.S., and consideration of joint funding and operation of future major projects. If international cooperation were to become so extensive as to result in programmatic dependencies, a careful assessment of the consequences of this interdependence would be undertaken.

I will now describe the Energy Research Analyses, University Research Support, University Research Instrumentation and, the Multiprogram General Purpose Facilities programs. The FY 1984 budget request for these programs is shown in Table 13 following my discussion of the programs. Before I discuss these outlay programs, however, I would like to comment on the advisory responsibilities of the Director of Energy Research.

ADVISORY AND ASSESSMENT ACTIVITIES

In addition to his outlay program responsibilities, the Director of Energy Research carries out statutory advisory responsibilities in several areas. These include serving as the principal science advisor to the Secretary on energy R&D programs, oversight of the non-weapons multiprogram laboratories and the education and training of scientists and engineers. The Office of Energy Research also provides staff support to the Energy Research Advisory Board (ERAB) whose members advise the Secretary on the Department's energy R&D programs. The Board's membership includes representatives from industry, universities, energy users, state and local governments and public interest groups. ERAB reports directly to the Secretary of the Department of Energy with staff support provided through ER's Director of Science and Technology Affairs staff.

Within the Office of Energy Research, the Office of Field Operations Management (FOM) and the Office of Program Analysis (OPA) support the Director's advisory responsibilities. The Office of Field Operations Management supports the Director with regard to oversight of the laboratories and energy-related manpower development and training activities. This Office has developed several management tools used by the Department in administering its laboratories and R&D facilities across the country. It also continues to manage the University Research Support and the Multiprogram General Purpose Facilities programs, as well as the new University Research Instrumentation program, all of which I will discuss shortly. The Office of Program Analysis, on the other hand, provides energy research analysis support.

ENERGY RESEARCH ANALYSES

The FY 1984 budget request for Energy Research Analyses is $2.9 million. This program provides the Department with the capability for independent, objective analyses of its technical needs and opportunities. The functions of this activity include assessing the adequacy of the long-range (technology base) research that supports the Department's R&D programs; carrying out independent analyses and technology assessments of the agency's R&D programs; providing coordination and direction in interagency activities such as acid rain research; coordinating resolution of major technical issues and research policy developments; and providing support to agency advisory groups such as the Energy Research Advisory Board. The program is carried out by the Office of Energy Research through studies, workshops, panels and other mechanisms which allow the Department to make use of the best available scientific and technical talent from industry, academia and the National Laboratories.

There were a number of accomplishments in each of the program's functional areas during FY 1982-83. Recent assessments of the Department's technology base included a review by the Fossil Energy Research Working Group, an industry, academic and Government work group who defined R&D needs in shale oil, tar sands and heavy oil. Several program analyses were completed including an assessment of the Office of Energy Research's Basic Energy Sciences program, a review of the research objective of the Battery Storage Program that led to a shift in program emphasis and an assessment that clarified the potential benefit of ethanol as a transportation fuel for the Office of Alcohol Fuels. Recent coordination responsibilities for the Department were related to participation in the Interagency Task Force on Acid Precipitation, the Interagency Working Group on Strategic Minerals Policy and the Interagency Program Board on Civil Operational Land Remote Sensing from Space.

The FY 1984 budget request would provide for up to three technology assessments, depending on their complexity, and up to four program assessments. Research analyses would include assessment of the quantifiable accomplishments of research programs, such as the Office of Health and Environmental Research, and reviews of research that crosscuts agency programs (e.g., acid rain). Coordination activities related to acid rain and civil land remote sensing would be continued and support would be provided to the Director, Office of Energy Research on reassessments of the Department's R&D priorities, programs and technology base. Independent peer review of technical or research subjects requested by principal Secretarial Offices or the Director, Office of Energy Research would be supported (e.g., the Coal Combustion Research Working Group, an industry, academic and Government group, will define research needs in coal combustion [illegible] early 1984). Finally, advisory groups, such as the Energy Research Advisory Board, will continue to be supported.

UNIVERSITY RESEARCH SUPPORT

The FY 1984 budget request for the University Research Support (URS) program is $5.5 million. The goal of this program is to assist in maintaining strong, energy-related scientific and technical research capabilities at universities and the national laboratories. The URS program provides a budgetary and programmatic focus for specialized research and manpower development efforts aimed at securing top quality energy researchers and broadening the pool of experienced scientists from which Government, universities and industry draw. This is accomplished by:

- Using the unique resources of the Department's National Laboratories to assist in university faculty and student research and training;
- Maintaining and strengthening university based energy research and manpower development efforts in selected high priority research fields;
- Increasing the number of students pursuing professional level degrees in energy-related science or engineering;
- Enhancing the quality of the scientific/technical workforce in the Department's national laboratories and;
- Helping to expedite the transfer of university-based energy research to potential users in the private sector.

The URS program consists of two major subprograms: The University/National Laboratory Cooperative Research program and the Energy Manpower Development program. The first of these programs, University/Laboratory Cooperative Research, has two elements: student/faculty training and university reactor fuel assistance. The FY 1984 budget request for these activities is $5.0 million. Of that $5.0 million, $3.5 million is requested to support efforts that bring university faculty and students to the national laboratories and other government contractor facilities for research and training. In addition to training for the participants, these activities provide the labs with additional research capability. During 1983, it is expected that over 1900 faculty and student participants will be involved in URS-supported activities at 32 laboratories and contractor facilities.

The University Reactor Fuel Assistance activity, with an FY 1984 budget request of $1.5 million, provides funds to assist in the purchase of nuclear fuel and related support for university-based nuclear research and training reactors. These reactors are essential to the training of future nuclear scientists and engineers. Fuel for the reactors is fabricated under contract to the Department and then "loaned" to the participating universities for use. Partial support is also provided for the operational expenses of a number of the university reactors when they are shared with researchers at neighboring universities. FY 1984 will be the first year of full production by a new contractor for the fuel required by the higher powered research reactors. Up to six such reactors would be refueled during FY 1984 and 12 reactor sharing grants would be made on a competitive basis. Support would also be provided for costs associated with the transport of spent fuel to designated fuel recovery sites.

The second URS program, Energy Manpower Development, consists of two manpower-oriented efforts. The FY 1984 budget request is $0.5 million. The Manpower Assessment activity analyzes the supply and demand of manpower for both current and future energy R&D programs. The Energy Education and Training effort supports activities aimed at encouraging secondary school students to pursue energy-related science and engineering programs at the college level. The FY 1984 budget request would provide for continuation or renewal of prior year budget activities.

UNIVERSITY RESEARCH INSTRUMENTATION

The University Research Instrumentation program is an initiative proposed for FY 1984 as part of the combined public/private sector effort to help alleviate the serious, national shortage of state-of-the-art, scientific instrumentation in the major research universities. The budget request is $6.0 million. The goal of the new initiative is to help universities strengthen their capabilities to conduct advanced, long-range research in specific energy R&D areas.

Direct access to state-of-the-art instrumentation often determines whether scientists can produce frontier-level results. However, the cost of the equipment is now so high that replacing obsolete equipment or obtaining new equipment is beyond the means of many research-oriented universities. The instrumentation required to Association of American Universities indicated that "the equipment used in the top-ranked universities. . . has a median age twice that of the instrumentation available to leading industrial research laboratories," with a large fraction of the equipment being obsolete.

During the last few years, the Department's national laboratories have been encouraged to increase the amount of time their research equipment is available to university researchers. Several unique, user-oriented research facilities (e.g., the Combustion Research Facility and the National Synchrotron Light Source) have also been established and are equally available to university, industry and laboratory researchers. Emphasis will continue to be placed on the cooperative use of existing equipment and facilities. However, a significant level of university research involves a large number of researchers (both faculty and students) who require continued access to certain instruments. In such instances the equipment must be available on-campus. Although the Department provides a small amount of support for research instrumentation on-campus, such instruments generally cost on the order of $35,000 or less and do not have the capabilities of the sophisticated instruments referred to above.

The University Instrumentation initiative would focus on university research groups with experience in designated research areas (e.g., combustion, biological energy conversion, catalysis, radioactive waste management, engineering research, etc.) of primary concern to both basic and technology-oriented energy research programs. Those groups supported would be assisted in obtaining the additional sophisticated instruments, each generally costing in excess of $100,000, which would enable them more effectively to conduct advanced research in the designated program areas. Awards would be made following a national competition based on such criteria as the merit and accomplishments of the institution's current applicable energy research programs, the potential for expanding and/or improving these programs if the new instruments where available on-campus, the institution's experience in planning for and using other major research equipment, the availability of similar instrumentation at nearby institutions, the institution's commitment to energy research and its plans for meeting and sharing the total costs associated with the instrument(s).

The $6.0 million requested in FY 1984 would enable some 20 to 30 university research groups to obtain some of the special research equipment they require to improve their capabilities to conduct energy research. A special interagency committee reporting to the President's Science Advisor, and chaired by the Director of the National Science Foundation, will provide overall policy guidance and ensure effective coordination of this and other agency research instrumentation efforts.

MULTIPROGRAM GENERAL PURPOSE FACILITIES

The FY 1984 budget request for Multiprogram General Purpose Facilities (MGPF) is $40.6 million (Table 14). The program's goal is to rehabilitate and replace multiprogram general support facilities that are essential to continued operation of the laboratories. These facilities include roads, railroads, site utilities and support buildings such as laboratories, office buildings and warehouses. The MGPF program is managed by the Office of Energy Research for the Department.

The major multiprogram laboratories and other Department of Energy sites included in the program received over $3 billion in FY 1982 to carry out research programs in nuclear energy, fusion, basic energy sciences, high energy and nuclear physics, life sciences, solar energy, fossil energy, conservation and defense. During stringent budget years it is often tempting to postpone necessary replacement or rehabilitation of deficient facilities in favor of maintaining a maximum amount of program effort in these research areas. We have learned from the experience of our predecessor agencies that such expediencies lead to negative impacts on the very programs they are aimed to protect. Equally important, they also result in an inventory of billions of dollars in corrective measures which some future generation will be expected to undertake. We plan, therefore, to continue the MGPF program, which began in FY 1981, as a necessary cost of doing business as long as the multiprogram laboratory facilities are utilized to perform research and development functions for the agency.

The FY 1984 budget request would continue construction of nine projects started in prior years and would initiate four critical projects: rehabilitation of Old Town area utilities, LBL (TEC $4.8 million); Cooling Water Facility, ORNL (TEC $4.0 million); road repairs (various sites - TEC $16.0 million) and a Facilities Support project (various sites - TEC $4.0 million). The Facilities Support Project provides for much needed facility-related improvements at several sites that are in the $1-2 million range. Projects in this size range are too large for traditional General Plant Projects funding and are too small and numerous to qualify for separate line item status.

ADVISORY AND OVERSIGHT PROGRAM DIRECTION AND POLICY AND MANAGEMENT

The FY 1984 budget request for Advisory and Oversight Program Direction is $3.4 million. These funds are required to provide for the salaries, benefits, travel and other expenses associated with 44 full-time equivalents. This FY 1984 request would provide staffing resources required by the Director of Energy Research to carry out his responsibilities under legislation (P.L. 95-91) and those mandated by the Secretary in areas beyond the scope of ongoing Energy Research programs.

The FY 1984 budget request for Policy and Management is $0.5 million. These funds are required to provide for the salaries and related expenses associated with 8 full-time equivalents in the Office of the Director of Energy Research and the Office of Management.

Mr. Chairman, this concludes my testimony. I would be pleased to answer any questions at this time.

Table 13

Energy Research Analyses, University Research Support, University Research Instrumentation, Multiprogram General Purpose Facilities--Budget Authority

	FY 1983 Estimate	FY 1984 Request
Energy Research Analyses	$ 2.8	$ 2.9
University Research Support	6.0	5.5
University Research Instrumentation	-	6.0
Multiprogram General Purpose Facilities	34.0	40.6

Table 14

Multiprogram General Purpose Facilities
Budget Authority
($ in millions)

	Prior Years	FY 1984 Request
Construction		
84-ER-101 Rehabilitate Old Town Utilities, LBL	0	1.0
84-ER-102 Cooling Water Facility, ORNL	0	0.6
84-ER-103 Road Repairs, various sites	0	3.0
84-ER-104 Facilities Support, various sites	0	4.0
Prior Year ongoing projects	34.0	32.0
Total	34.0	$40.6

SUMMARY OF STATEMENT

Dr. TRIVELPIECE. As you indicated, you have my prepared statement. It contains all the fiscal year 1984 budget request details for the programs I will discuss today. I'm certainly not going to go over all those details. I did want to make some introductory remarks concerning some of the emphasis in the fiscal year 1984 request for these programs. It is my belief, and I hope yours too, that the long-term economic health of the United States requires stability and a certain commitment to research and development and long-range planning related thereto.

The programs we are discussing this afternoon amount to about $1.69 billion in total. They include high-energy physics, nuclear physics, basic energy sciences, and medicine, some basic magnetic fusion, biological, and environmental research, a university research instrumentation program, the university research support program, and other related support activities.

I would like to start by pointing out that the administration, even in this time of budgetary stringencies, has tried to present a budget which emphasizes some of the long-range basic research and development. The fact that this emphasis is being provided even in these times of budgetary stringencies certainly identifies the strength of this commitment. However, in making this commitment, it is not our intention to simply support the next 10 percent or so of good research at the margin, but, rather, our intention has been to select out certain activities for special emphasis. We hope that these activities reflect the kind of emphasis that will make an impact on the long-range R&D in the country.

ENERGY RESEARCH ADVISORY BOARD

Last year the Department of Energy convened, through its Energy Research Advisory Board, a panel of individuals to review the national laboratories. This group delivered its report which contained many recommendations. There is a central theme in these recommendations, and that is, we should try to regard the laboratories as institutions rather than simply as organizations or sites at which projects are done; that we should try to redirect the labs in ways that might take better advantage of their capabilities, or direct them into newer or scientifically more productive areas; that we should try to utilize the labs in a way that improves their interaction with the industrial complex of the United States; and finally, that we should seek to involve them in ways that benefit the research and educational aspects of higher education in the United States.

These, I certainly hope you would agree, are all good suggestions. We are trying to take these suggestions into account in the form of some initiatives in our fiscal year 1984 budget request.

NATIONAL CENTER FOR ADVANCED MATERIALS

The first of these initiatives that I would like to talk about is the National Center for Advanced Materials at Lawrence Berkeley Laboratory. As an example of the need for better materials the United States loses annually due to erosion and rust and corrosion of materials, some estimated $80 billion. It is estimated that fracture and cracking of materials results in losses probably in excess of $100 billion.

What we have tried to do is to take into account the recommendations of the Energy Research Advisory Board to recognize certain of these national materials needs. Thus, this initiative's chief thrust is to redirect certain activities at Lawrence Berkeley Laboratory. We are proposing to begin construction there of a facility that involves several elements which will combine educational activities with scientific research activities. The total NCAM initiative amounts to a request in fiscal year 1984 of $38 million. These funds would allow initiation of construction of certain facilities at Lawrence Berkeley and at the Stanford Synchrotron Radiation Laboratory, which together comprise the National Center for Advanced Materials. In addition, this initiative also includes an expansion of the National Synchrotron Light Source at Brookhaven National Laboratory.

There has been some concern expressed in the scientific community that we have, perhaps, proceeded in a manner that is not the conventional or traditional approach to the decisionmaking process related to the establishment of the facility at Lawrence Berkeley Laboratory.

We would like to proceed with this facility as soon as possible. However, recognizing the concerns of some scientists, I am creating a special ad hoc panel to report directly to me. This panel will include leaders from industry, universities, and from other national laboratories to look at the programmatic and technical features of this facility to try to assist me in improving it.

UNIVERSITY INSTRUMENTATION PROGRAM

Another initiative contained in this budget involves a request for $6 million for university research instrumentation. This is a new program in recognition of the fact that universities have had a certain deterioration of the capital equipment used for their research and teaching in the areas of science and technology. This deterioration has taken place over a number of years and has been recognized by several other agencies which have formed a committee to try to remedy this situation. We are requesting $6 million in fiscal year 1984 to begin to try to alleviate the kind of university instrumentation deficiencies that have been clearly recognized and which I believe are very serious.

In somewhat the same spirit, we are seeking $8 million for the upgrade of two nuclear physics accelerators. One is at the University of Washington and the other one is at Yale University. These upgrades are well justified on their scientific merits alone. However, they are not being proposed exclusively for scientific purposes, but also because these two institutions have been particularly effective in training graduate students in this area of research.

STANFORD LINEAR COLLIDER

The final initiative involves a facility which represents the normal extension of activities previously undertaken; that is, to begin the construction of the Stanford linear collider at the Stanford Linear Accelerator

Center. We are asking for $40 million to begin construction of this facility. It has a total estimated cost of around $112 million. This facility will extend the useful life of the Stanford Linear Accelerator Center in a very practical way.

One of the reasons for beginning this facility and completing it has to do with the desire to create a facility that will produce the kinds of particles that are required for a more complete understanding of fundamental properties of matter and the basic forces of nature.

The fact that we are starting this now is timely, if you take into account the recent discovery of the W particle at the CERN Laboratory near Geneva. It is difficult to put into context abstract physics concepts such as the existence of the W particle, but let me attempt to do so.

It is well known that matter is made up of atoms and that atoms are made up of protons, neutrons, and electrons. It turns out that within a proton, there are still smaller objects which are referred to as quarks. There are three quarks in a proton, and three antiquarks in an antiproton. When you cause these particles to be collided at very high speeds, then occasionally, one of the quarks in the proton will collide with its antiquark counterpart in the antiproton and cause this W particle to come into existence.

The W particle decays very rapidly into other particles. It is from sorting through the products of thousands of these collisions that the high-energy physicists at the CERN Laboratory have been able to make an unambiguous confirmation of the existence of the W particle. The Stanford linear collider facility as a facility would make a copious supply of these particles, as well as of a close cousin, the so-called Z^0 particle, available for study by our scientists.

I would like to close by congratulating the scientists at CERN for their remarkable work in causing the discovery of this particle to take place. It is certainly a landmark event in the world of high-energy physics.

Mr. Chairman, I would be happy to answer any question you might have.

Chairman HATFIELD. Thank you.

STANFORD LINEAR ACCELERATOR CENTER

WEAPONS-RELATED RESEARCH ACTIVITIES

Dr. Trivelpiece, could you tell us, for the record, whether weapons-related research has been conducted at the Stanford facility in the past?

Dr. TRIVELPIECE. The nature of your question must stem from the newspaper articles that have been written recently concerning some of the employees at Stanford making statements regarding weapons research at Stanford University.

From my recollection, Stanford used to do classified research back in 1946, 1947, and 1948. Somewhere in that period, there was a decision by the university to not accept research that was classified. So that is an agreement between Stanford University and the Federal Government that the research being done on campus be unclassified. The results of the research being done at Stanford that is supported by the Department of Defense, the Department of Energy, and other agencies can be published in the open literature. So there is no prohibition at Stanford against unclassified research of any kind supported by the Government.

There has been a proposal by some scientists at Lawrence Livermore Laboratory which is primarily supported by DOE's weapons program. Through the user's group for the so-called Stanford Synchrotron Radiation Laboratory, the Livermore scientists have proposed to conduct some calibration experiments and do some other basic research. That proposal has to be reviewed by the user's group and the user committee at Stanford. If the Livermore proposal meets the appropriate scientific tests, it should be allowed to be done at the Stanford Synchrotron Radiation Lab. The fact that the proposal is coming from another Government laboratory should make no difference, if the work to be done is unclassified. There should be no impediment to the scientists at Stanford being able to perform it.

Once again, the proposal should meet the test of scientific acceptibility, but the fact that it is coming from Livermore, or for that matter any other laboratory, should not be relevant to the issue here.

The employees there are obviously not speaking for the management of either Stanford University or the Stanford Linear Accelerator Center.

Chairman HATFIELD. Is funding for the accelerator activity in 1984 a budget request?

Dr. TRIVELPIECE. No, there is no funding requested for this activity in the Office of Energy Research budget.

Chairman HATFIELD. Within the context of Stanford?

Dr. TRIVELPIECE. No. The proposed work would be funded through the defense programs in DOE, so the equipment and the time and so on——

Chairman HATFIELD. Not in high-energy physics programs?

Dr. TRIVELPIECE. The Stanford Linear Accelerator is a high-energy physics facility. The costs of operation of the facility would be funded by the high-energy physics program. However, the Stanford Synchrotron Radiation Lab light source beam would be made available for research at no cost, assuming that it meets the scientific standards indicated earlier.

We operate a facility——

Chairman HATFIELD. Is this an interagency funding program, then, are you saying, that there is such a program that is funded from the defense budget rather than high-energy physics?

Dr. TRIVELPIECE. Let me explain further. We operate a number of facilities which provide services, whether they are neutron sources or synchrotron light sources or whatever. If somebody makes a proposal to use that facility for scientific purposes and they agree to publish the results in the open literature, then the facility is made available to them. We don't charge them fully burdened cost for utilizing the facilities. They are made available to all comers on an equal basis, assuming the qualifications are on a scientifically acceptable basis.

Chairman HATFIELD. Do you have any personal views about these expression of—you call them employees?

Dr. TRIVELPIECE. To the best of my knowledge, the individuals are employees of either Stanford University or the Stanford Linear Accelerator Center.

Chairman HATFIELD. Much like a faculty member is an employee, but these are scientists?

Dr. TRIVELPIECE. No, not necessarily. I really don't know the——

Chairman HATFIELD. Then the paper was incorrect in referring to them as scientists?

Dr. TRIVELPIECE. I would assume so, but I don't know.

Chairman HATFIELD. Could you provide for the record what percentage are scientists and what percentage are employees in a sense like a clerical or some other activity?

Dr. TRIVELPIECE. I will look into it. I'm not sure that it would be easy to come by that information since the individuals employed by the State of California just as easily——

Chairman HATFIELD. I am just referring to the term "employees." I don't know whether that is a demeaning term you are using or whether that is a definitive term.

Dr. TRIVELPIECE. It was the first thing that came to mind. The group we are discussing was a collection of individuals, some of whom I believe are employees, some of whom may be faculty members, some of whom may be individuals having no association with the university or the Stanford Linear Accelerator Center whatsoever.

Chairman HATFIELD. Would you so refer to a body of scientists as employees?

Dr. TRIVELPIECE. Well, I would think if they were employees of the University of California and members of the faculty, I would feel free to call them by either designation.

Chairman HATFIELD. As you would refer to a faculty member as an employee?

Dr. TRIVELPIECE. Yes; certainly the university looks on them as employees. Having been a faculty member for 20 years, I can tell you that the university certainly thought of me as an employee.

Chairman HATFIELD. Having been a faculty member for 7 years, we were never referred to as employees. We never referred to professors at Stanford, my alma mater, as employees.

Dr. TRIVELPIECE. Mr. Chairman, I will submit for the record information regarding the petitions to Stanford University.

[The information follows:]

PETITIONS REGARDING WEAPONS-RELATED WORK AT STANFORD

The petition to the university was signed by 15 of the 31 faculty scientists at the Stanford Linear Accelerator Center (SLAC). There was also a private petition to the SLAC director, signed by about 280 of the 1,500 SLAC staff. No additional faculty members were among these. Of the 280, 30 were scientists, 180 were engineers and technicians, and 70 were administrative and clerical personnel. Thus, about 20 percent of SLAC staff signed the petition.

ISABELLE

Chairman HATFIELD. How much was requested for fiscal year 1984 for the ISABELLE-related construction activities?

Dr. TRIVELPIECE. We have not requested any funds for construction of the ISABELLE project in fiscal year 1984.

Chairman HATFIELD. And operating expenses?

Dr. TRIVELPIECE. ISABELLE is not an operating facility, so we have not budgeted funds to operate it. However, there are operating expense funds of $23 million in the fiscal year 1984 request for research and development having to do with the superconducting magnets in a possible future facility.

Chairman HATFIELD. What are the current operating costs associated for the ISABELLE project?

Dr. TRIVELPIECE. The most recent cost estimate was prepared by Brookhaven National Lab in October 1981. That estimate projected total estimated cost for construction, including escalation, at $464.9 million. An updated estimate is being reviewed by a committee at the moment.

NUCLEAR MEDICINE PROGRAM BENEFITS

Chairman HATFIELD. Dr. Trivelpiece, could you discuss briefly, summarize, in both human and economic terms, the benefits that have been derived from nuclear medicine programs?

Dr. TRIVELPIECE. That is a tall order. I will try to summarize, but I would like to supply some answers for the record.

Chairman HATFIELD. We would be happy to have that.

Dr. TRIVELPIECE. The decision to include a nuclear medicine program under the auspices of the Atomic Energy Act was a brilliant idea by whoever the people were who prepared that law. At the present time, it is estimated that there are something like 70 million nuclear medicine applications applied to some 40 million patients annually throughout the United States. We can multiply that by some number of dollars to get an idea of the cash flow that is associated with these applications. One can then assume that some fraction of these costs are physicians' income and figure that the United States is undoubtedly receiving in the form of income tax, an enormous benefit from the investments in the nuclear medicine program that were made by the Atomic Energy Commission and successor agencies up through and including DOE.

That kind of simple numerical analysis, of course, does not convey the true sense of the worth of this program in terms of human values, such as extension of life and reduction of human suffering through noninvasive and therapeutic diagnostic applications. The PET scans that are now being used in order to look into such things as Alzheimer's syndrome in a way that was simply heretofore impossible have their origins in this program. Some cancer therapy can be very effective using charged particle beams, and so on.

We have done a study in the last year that seeks to put some of these things on a quantitative basis. The study will be finished in the near future. I would certainly be glad to supply the report to you when it becomes available.

Chairman HATFIELD. A rather remarkable record.

Dr. TRIVELPIECE. It is an incredible record by any standard.

[The information follows:]

Nuclear Medicine Applications

The benefits from the nuclear medicine program can best be described by looking at specific diagnostic procedures and instrumentation which have been developed under DOE sponsorship and have found clinical utility in the treatment of human disease.

There are two major techniques for diagnosing whether patients with symptoms of coronary disease in fact have such disease. One involves the injection of opaque dye into an artery near the heart, after which the motion of the dye is followed by fluoroscopy. This technique, called cardiac catheterization, is painful, expensive and carries risks. The other technique, developed in the nuclear medicine program, involves injection of the radioisotope Thallium-201 into the bloodstream, and subsequent detection of the uptake of this tracer in cellular tissue. Reduced uptake of Thallium-201 in a region indicates either reduced blood flow or damage to cells, or both. Thus, the technique can detect damage to the cells of the heart and reduced blood flow to the heart. The technique is relatively inexpensive, noninvasive and low-risk. For the 370,000 patients who undergo the scan annually and avoid the necessity for more expensive catheterization, this has meant an estimated savings of $78 million per year in medical expenses.

The radioisotope Gallium-67 has been used in a number of applications in nuclear medicine due to its property of concentrating in tumors and abscesses and due to the detectability of its gamma-ray emissions. Gallium-67 scanning is particularly useful in the diagnosis of Hodgkins Disease, in which it also permits discrimination between the various stages of this disease. The ability to discriminate is valuable, because treatment is specific to each phase of the disease. The benefit of the scan to patients who have not yet reached the most severe stage of the disease, in terms of avoidance of unnecessary medical expenses and loss of productive time alone, is estimated to be $10 million annually. In all applications, over 250,000 Gallium-67 scans are performed annually at a cost of $5 million for the radiopharmaceutical alone.

The familiar "Cat Scan", Computed Axial Tomography Scanning is a vital tool in medical diagnosis, yielding three-dimensional views that reveal body structure in striking detail. However, because CAT Scans cannot depict the active functioning of body organs, there was a further need for a device that could provide such views of regional physiological functions, such as blood flow and glucose metabolism in the brain. This led to the development of the "PET" scan, Positron Emission Tomography, which utilizes a short-lived radioisotope of some element that occurs naturally in the body, for example, oxygen, nitrogen, and carbon. The emissions of these radioisotopes are detected and processed by computer to reconstruct images of the internal distribution of the radioisotope, and thus, the functioning of the organ of interest. Several companies now manufacture the Positron Emission Tomography scanner at costs of about one million dollars per unit. It is considered to be enormously valuable in diagnosing and understanding diseases of the brain, heart, and lungs.

The Scintillation or Anger Camera, so named for its inventor, was devised to obtain successive images of the distribution of a radioactive tracer within the body following intravenous injection of the tracer. Thus, it is used widely in conjunction with diagnostic tracer techniques utilizing the radioisotopes, Thallium-201 and Technetium-99m, representing 85 percent of all in vivo studies in nuclear medicine. About one in four patients in American hospitals has an examination with the scintillation camera as part of the process of medical diagnosis. Almost 7,000 such cameras are distributed among hospitals of all sizes in the United States, of which 3,000 are used in conjunction with computers to enhance the images produced.

Hyperthyroidism is characterized by excessive levels of circulating thyroid hormones, can be marked by a variety of clinical conditions, including increased metabolic rate, enlargement of the thyroid gland, rapid heart rate, and high blood pressure. The three major treatments for this condition, surgery, drugs or Iodine-131 therapy, focus on destroying the abnormal thyroid tissue that is producing the excess hormone. Surgery to remove the thyroid gland is painful, expensive and carries risks. The use of drugs requires long-term treatment, incurs possible side effects and may eventually end in surgery. However, it was found in the early 1940's that the Iodine-131 radioisotope concentrates in the thyroid gland, and preferentially destroys overactive tissue through short-range particle emissions. The early discovery of this treatment and its selectivity are evident from the fact that from the mid-1940's to the 1960's, Iodine-131 was the principal radioisotope used in nuclear medicine. For almost 50,000 persons each year in the United States who undergo Iodine-131 treatment in place of surgery, the annual savings in terms of productive time and lower medical costs have been computed to be $280 million.

Financial returns from the Nuclear Medicine program may be appreciated by examining the following tabulated information: Data [a] (1978 Dollars) assembled from "An Economic Study of the Radionuclides Industry," Centaur Associates, J. Birdsong, NUREG/CR-2048, July 1981, p. 95.

YEAR[b]	Sales ($ Millions)	EMPLOYMENT (1,000)	WAGES & SALARIES ($ Millions)	ANNUAL CAPITAL Expenditures ($ Millions)
1967	1,850	56.9	880	120.7
1973	3,030	86.5	1,350	204.5
1975	3,540	98.2	1,540	236.9
1977	4,270	115.8	1,820	290.6
1978	4,550	123.3	1,940	306.5

[a] Compiled from estimated economic activity of (1) Medical Accelerator Users, (2) Medical Suppliers, (3) Medical Research, and (4) Medical Diagnosis and Therapy. Not included because inseparable from non-medical are radionuclide imports and exports, personnel safety goods and equipment for handling radionuclides.

[b] 1969 and 1971 also available were not included because they did not add enough to the picture.

10 to 15 percent of the above amounts could easily come back to the Federal Government in taxes - a substantial increase over research dollars spent (ranging from $14.0 million in FY 1975 to $21.0 million in FY 1984.

NUCLEAR MEDICINE PROGRAM REDUCTION

Chairman HATFIELD. Then why have you proposed program cuts in real terms over the last 2 years, particularly when other programs have had much higher funding?

Dr. TRIVELPIECE. The nuclear medicine applications part of the biological and environmental research program has, in fact, stayed about constant. It is the overall biological and environmental research program that has gone down. This has been a question of priorities and priorities at the margin. While there is nothing wrong with the program, there has been a need to try to meet overall budget stringencies in this particular period.

It has not been possible within those constraints to support this program as strongly as perhaps some of us would like.

Chairman HATFIELD. Is this budget presentation figure in your request figure?

Dr. TRIVELPIECE. The request for the total biological and environmental research program is $170.2 million. The nuclear medicine applications part is $21 million.

Chairman HATFIELD. Is this the same figure pre-OMB review or post-OMB review?

Dr. TRIVELPIECE. Post-OMB review.

Chairman HATFIELD. What was the pre-OMB review figure?

Dr. TRIVELPIECE. The departmental request to OMB was $205 million for the biological and environmental research program.

Chairman HATFIELD. That is—what about the——

Dr. TRIVELPIECE. That figure is for the biological and environmental research program which in fiscal year 1984 includes the life sciences research and nuclear medicine applications programs.

Chairman HATFIELD. Could you extrapolate the nuclear medicine figure, pre and post?

Dr. TRIVELPIECE. For nuclear medicine, the request to OMB was $21.8 million and the President's budget is $21.0 million.

Chairman HATFIELD. So you only suffered an $800,000 reduction?

Dr. TRIVELPIECE. In that component of the budget, yes, sir.

ADDITIONAL PREPARED QUESTIONS FOR THE RECORD

Chairman HATFIELD. Doctor Trivelpiece, we have a number of other questions that I would like to submit to you for your response for the record. And if you care to expand or provide any other materials that you would like to submit for the record, you are welcome to do so.

[The questions and answers follow:]

QUESTIONS SUBMITTED BY SENATOR HATFIELD

Importance and Standing of U.S. Program

Question: Please discuss the importance of the U.S. program and its competitive position in the world.

Answer: High Energy Physics has made many important discoveries during the past decade that have pushed forward the frontiers of knowledge in a major way. These discoveries resulted from studies on the ultimate structure of all matter, on the most basic forces in nature, and on the transformations between matter and energy at the most elemental level. The basic knowledge gained through high energy physics research is applicable to all physical and biological processes. The study of the basic nature of physical and biological systems offers new, longer term possibilities, including the possibility of achieving new sources of energy.

The support of basic research is principally associated with highly industrial and technologically advanced countries. This is no historical accident. It represents a conscious commitment based on an understanding of the importance and priority of a strong basic research effort to national health. There is a strong feedback mechanism between science and technology, both from a technical point of view and a manpower point of view. A strong educational system provides the highly trained base of personnel required for both basic research and technologically advanced industry. Both require an influx of aggressively inquisitive and inventive minds. Basic research encourages the exploitation of established and new technology to explore new scientific frontiers; and the latter offers technology new ways and means of solving practical problems.

The USSR, Western Europe, Japan and the U.S. all have very vigorous research programs in the field of high energy physics. Somewhat over a decade ago the magnitude of the high energy physics efforts in the USSR, Western Europe and the U.S. were comparable in size, with the U.S. having acknowledged leadership and dominance in the field. The high energy physics program in Japan was modest in size.

Western Europe has initiated a deliberate policy of support for basic research. Today the size of the Western European program is nearly twice the size of the U.S. program, with the USSR program near that of the U.S. in size. The Japanese program has grown substantially, to nearly a third the size of the U.S. program and is rising. Today the U.S. and Western Europe are the acknowledged leaders in high energy physics, with cooperation and competition both being very vigorous. Western Europe has made decisions to build 2 new major billion dollar facilities in the 1980's; a Large Electron Positron (LEP) collider with the first phase being 50 GeV x 50 GeV at CERN and a 30 GeV x 800 GeV electron proton colliding beam facility, HERA (Hadron-Elektron-Ring-Anlage), at Deutsches Elektronen-Synchrotron (DESY) in Hamburg; the USSR has embarked upon a 3 TeV fixed-target superconducting proton accelerator at Serpukhov; and the Japanese are well on their way with a 30 GeV x 30 GeV electron-positron collider, TRISTAN, as a first phase of a plan which will later add a 30 GeV x 300 GeV electron-proton colliding beam capability. In the U.S. the Tevatron 1000 GeV x 1000 GeV proton-antiproton collider and 1000 GeV fixed-target accelerator are the current major improvement efforts at the Fermi National Accelerator Laboratory. Initiation of construction of the 50 GeV x 50 GeV linear electron-positron collider, Stanford Linear Collider (SLC), as an important new upgrading at the Stanford Linear Accelerator Center is requested for the FY 1984 budget.

In addition to recent high energy physics discoveries such as charmed particles, the tau lepton, the upsilon particle, and others, progress in high energy physics research has resulted in the development of advanced technology such as a new superconducting magnet technology, new electronics, new types of computers, and new medical technology. It is noteworthy that during the past 6 years, 7 U.S. scientists have shared in Nobel Prize Awards in Physics for their research in high energy physics; and 2 other U.S. scientists have received Nobel Prizes for research applications of high energy physics techniques. Past history has shown that the major accomplishments of the high energy physics program have a wide scope that benefits society in an unpredictable and multifaceted manner.

Three National Centers

Question: Comment on the need for maintaining three national accelerator centers.

Answer: The three U.S. centers each provide a set of unique capabilities, complementary to each other and those at other sites. Together the three laboratories provide the basis for a comprehensive, worldwide competitive U.S. program.

High energy physics research probes a broad range of phenomena related to the fundamental constituents of matter and the basic forces in nature. To pursue the many facets of the research frontiers and to pursue important scientific opportunities which push forward the frontiers of knowledge as they arise, a variety of particle probes, of different types and energies, are required, along with a diversity of detection apparatus.

The present U.S. system of three laboratory centers, which has evolved over a period of years, has proven highly effective in meeting the research challenges. The U.S. program, despite serious challenges, is still a world leader. U.S. scientists have won or shared in all of the recent Nobel Prizes in high energy physics research.

Question: What is the estimated utilization rate in FY 84 for each existing accelerator and how does this compare with FY 83?

Answer: I will submit a table for the record which shows the estimated utilization rate at existing high energy accelerator facilities for FY 1983 and FY 1984. We expect to achieve an overall facility utilization in the 55-60% range in both fiscal years.

ESTIMATED UTILIZATION OF HIGH ENERGY PHYSICS ACCELERATOR FACILITIES

	FY 1983*	FY 1984
Brookhaven National Laboratory Utilization (Weeks)	30	30
Fermi National Accelerator Laboratory Utilization (Weeks)	36[a]	36
Stanford Linear Accelerator Center Utilization (Weeks)		
a. Pulse Rate, Linac (%)[b]	26%	25%
b. Weeks of Operation	36	36

* Based on DOE/OMB interpretation of distribution of resources under the FY 1983 Continuing Resolution

[a] FY 1983 is the year of commissioning and possible initial operation for the superconducting Energy Saver accelerator with the existing conventional accelerator being operated at 150 GeV as an injector into the Energy Saver. FY 1984 is expected to include full operation of the Energy Saver and the initiation of the early phase Tevatron II 1000 GeV program at Fermilab, opening exciting and unique new research opportunities.

[b] Pulse rate is a major factor for fixed-target experiments only. Utilization of the Stanford Linear Accelerator Center's SPEAR and PEP electron-positron colliders is determined by the number of weeks of operation.

Question. Please provide a table for the record showing power costs and utilization levels over the last 5 years for each accelerator.

Answer. The following table shows the power costs and utilization of the accelerators supported in the U.S. High Energy Physics Program of the Department of Energy.

Power Costs and Utilization for Major Facilities in High Energy Physics

	Fiscal Year				
	79	80	81	82	83*
Brookhaven National Laboratory					
Power (Gigawatt Hrs.)	118.4	116.4	104.9	82.5	115.6
Power Cost (Millions $)	3.45	5.07	7.02	4.55	7.40
Utilization (Weeks)	30	26	24	20	30

Fermi National Accelerator Laboratory					
Power (Gigawatt Hrs.)	377	308	300	292	200[a]
Power Cost (Millions $)	8.1	9.1	10.1	12.2	9.8
Utilization (Weeks)	34	28	23	21	36
Operating Energy (GeV)	400	350	350/400	400	500[a]
Stanford Linear Accelerator Center					
Power (Gigawatt Hrs.)	174.0	192.6	292.7[b]	283.0	303.5
Power Cost (Millions $)	1.30	1.63	3.10	3.00	4.50
Utilization:					
a. Pulse Rate, Linac (%)[c]	20	22	25	19	26
b. Weeks of Operation	31	34	36	32	36
Argonne National Laboratory					
Power (Gigawatt Hrs.)	152.5				
Power Cost (Millions $)	4.00				
Utilization (Weeks)	40				

*Based on DOE/OMB interpretation of distribution of resources under the FY 1983 Continuing Resolution.

[a] FY 1983 is the year of commissioning and possible initial operation for research of the superconducting Energy Saver accelerator, with the existing conventional accelerator being operated at 150 GeV as an injector into the Energy Saver.

[b] FY 1981 was the first year of the Positron-Electron Project (PEP) operations at Stanford Linear Accelerator Center.

[c] Reduced pulse rate affects fixed-target experiments, but not those done with the SPEAR and PEP colliders which depend primarily on weeks of operation.

Fluctuations in Operating Levels

Question: What impact do large fluctuations in facility operation levels have on this type of research work?

Answer: High energy physics research requires stable and adequately supported facility operations to achieve efficient use of facilities and allow scientists to respond quickly to the challenges of new discoveries vital to understanding the laws of matter and energy. An experiment in high energy physics typically takes 3 to 7 years for the design, fabrication, data accumulation and analysis. Disruptions of the schedule due to budgetary shutdowns of the accelerator can add a year or more to each endeavor. Oscillations in the level of facility operations can lead to uncertainties and inefficiencies of experimenters and laboratories in planning and performing research. University-based scientists, who comprise the major part of the researchers, require reliable advance scheduling to phase their research activities into their academic schedule. Large fluctuations in facility operations make it difficult to hold together the large experimental collaborations which are often composed of scientists from many institutions.

Reductions in facility operations, reflected in reschedulings and delays in mounting and running experiments at the laboratories, result in inefficient use of the national research facilities and long queues of researchers waiting to perform their experiments. Too short a running time during any year can require an experimenter to wait another year to complete data accumulation. The resultant lengthened time to complete experiments is highly discouraging and demoralizing to the researchers. The discouragement of graduate students and potential graduate students has a deleterious effect on the next generation of researchers, and thus on the future. Improvements in facility operations with proper notice and preparation can greatly enhance the research productivity.

Inflation Factor

Question: What inflation factor was used in developing the FY 84 request for facility operations and other support activities?

Answer: The inflation factor used in developing the high energy physics operating budget request is 7.9 percent based on the High Energy Physics Cost Inflation Analysis developed in September 1982. This is consistent with the March 1983 update which indicates an inflation factor of 7.6 percent.

Construction Funding and Stanford Linear Collider

Question: Provide the committee with a breakdown of the FY 84 increase in construction. How much is provided for Stanford Linear Collider (SLC) and why is a rapid schedule proposed?

Answer: I will provide a table for the record showing a breakdown of the FY 1983 authorizations for high energy physics construction-related funding and the FY 1984 request. Funds being requested in FY 1984 for Tevatron I and Tevatron II are required to continue construction of these projects as planned. The amounts requested in FY 1984 for Accelerator Improvement Projects and General Plant Projects, which show a combined increase of $1.5 million, are to maintain a constant level of effort for these activities which are essential on an annual basis to maintain the efficiency, reliability and scientific effectiveness of the accelerator facilities and to maintain the effectiveness of the general laboratory plant. The needs in FY 1984 are particularly strong in view of the needs for the new facilities expected to be on line at Fermi National Accelerator Laboratory. No funds are being requested in FY 1984 for the Colliding Beam Accelerator at Brookhaven National Laboratory.

The major new construction initiative requested in FY 1984 is the SLC project at the Stanford Linear Accelerator Center for which $40 million is being requested for the first year. The 3-year construction schedule requested for the SLC is the optimum, natural schedule which leads to greatest efficiency and cost effectiveness to the Government. Extensive research and development and advanced engineering have already been conducted and the project is ready to move ahead expeditiously. The schedule is also influenced by the physics interests. Constructing the SLC on a 3-year schedule, with completion in 1986, gives U.S. scientists earliest access to the highly exciting physics associated with the anticipated copious production of the Z^0 particle. This is important for maintaining the U.S. worldwide competitive position in the field.

High Energy Physics Construction
(B/A in Millions)

	FY 1983	FY 1984	Change
AIP	8.0	9.0	+1.0
GPP	6.5	7.0	+0.5
Tevatron I	18.0	20.0	+2.0
Tevatron II	18.0	13.0	-5.0
ISABELLE	5.0	-	-5.0
SLC	-	40.0	+40.0
	55.5	89.0	+33.5

Fermilab Capital Equipment

Question: Describe in detail the capital equipment request for Fermilab and why it is given priority.

Answer: The Fermi National Accelerator Laboratory (Fermilab) capital equipment is largely related to implementing the 1000 GeV research capability made possible by the Energy Saver superconducting accelerator along with the Tevatron I and Tevatron II upgrading. The total request is $27,500,000 for FY 1984. A major component of the increase is $10,000,000 toward the fabrication of the Collider Detector which is required to permit study of the 1000 GeV x 1000 GeV proton-antiproton collisions to be provided by Tevatron I. This exciting physics capability is in a totally new energy range and will permit important experiments, including a major extension of the recent important results on the W particle. Another major element is $13,000,000 for secondary beam line components and detection equipment which are essential to make use of the 1000 GeV fixed target capability provided by Tevatron II. The Tevatron II program is expected to carry the major share of the U.S. research effort through the remainder of the 1980's. The work in FY 1984 on major new beams will include the new muon beam ($900,000), wide band photon beam ($1,500,000), prompt neutrino beam ($1,800,000), polarized proton beam ($400,000) and a new high energy pion beam in the Meson Area ($800,000). The detector work will include $3,000,000 for nine approved experiments in the Neutrino Area, $1,200,000 for three approved experiments in the Proton Area, $900,000 for approved experiments in the Meson Area and $400,000 for other new experiments. The remainder of the requested funding will be used to support accelerator replacement units, computing equipment and support equipment for the research program and site operation. When the Tevatron program is fully implemented, it will provide a worldwide unique capability for the U.S. which will serve a large fraction of U.S. users.

ISABELLE

Question: How much is requested in FY 84 for operating expenses and construction for ISABELLE related activities.

Answer: The FY 1984 budget requests $23M in operating funding for the Colliding Beam Accelerator (CBA) research and development (R&D) program at Brookhaven National Laboratory (BNL). No construction funding is being requested for FY 1984. Because of the high technical and cost risks involved in the forefront superconducting magnet technology being utilized for the CBA, it is considered prudent and appropriate to fabricate and install an initial sector (1/12) of the machine as an R&D effort. If the project is approved, this is anticipated to be the primary thrust of the FY 1984 program. The results of CBA R&D will contribute significantly to advancing the technology of high field large aperture superconducting magnets. This contribution will assist the program even if a colliding beam accelerator is not constructed at BNL.

Question: Discuss the problems with the project and the need for further R&D.

Answer: The ISABELLE project encountered serious technical problems with the superconducting magnets in 1980-81 and the project was placed in an research and development (R&D) mode in mid FY 1982. The R&D effort for a Colliding Beam Accelerator (CBA) at Brookhaven National Laboratory (BNL) includes major efforts on the superconducting magnet design and development and demonstration of techniques to fabricate magnets with appropriate field quality in a reproducible, cost-effective manner; consideration of alternate magnet and facility designs that could lead to a lower cost facility; and installation and testing in the ISABELLE tunnel of a string of 30-40 prototype R&D magnets. Smaller R&D efforts are continuing in the other technical areas, particularly cryogenics.

While BNL is making very good progress with the R&D program on superconducting magnets, the agreed to demonstrations of the adequacy of the magnet design have not yet all been completed. The series of field quality magnets are still being fabricated and the full cell tests are just getting underway. The planned DOE review on April 11-14 will look at the technical status of the magnet system and the other technical systems, as well as projected cost, schedule and management. From this review, we hope to get a much better idea of the technical status of the project.

The need for continued R&D in FY 1984 is related to the forefront developmental nature of the superconducting magnet effort which is pioneering the development of an entirely new technology. It is considered important to fabricate and install an initial sector (1/12) of the machine as an R&D effort. This will provide the critical systems tests on a complete sub-unit of the machine and will permit fabrication and installation techniques to be perfected.

Question: What are current cost estimates for construction of the project.

Answer: The most recent cost estimate for the ISABELLE project was prepared by the Brookhaven National Laboratory (BNL) in October of 1981. That estimate projected a total estimated cost (including escalation from 1981) of $464.9 million. This included the $119 million appropriated through FY 1982, and assumes major funding in FY 1983. BNL is in the process of preparing a new proposal, to be submitted to DOE by March 30, 1983. This proposal will present BNL's new technical plans as well as cost and schedule projections.

Question: Do you anticipate a lower cost facility being proposed by BNL?

Answer: Brookhaven National Laboratory is preparing a proposal for a Colliding Beam Accelerator based on the facility and magnet designs resulting from the research and development program which has been underway since mid FY 1982 and taking advantage of the investment in ISABELLE. This proposal is scheduled for delivery to DOE at the end of March, and we have planned an in-depth review of the cost and technical aspects of this proposal for mid-April. Although we do not know the contents of the new proposal, we anticipate that the projected costs in the new proposal will be lower than those for the previous ISABELLE facility.

Stanford Synchrotron Radiation Laboratory

Question: Has weapons-related research been conducted at the Stanford facility in the past?

Answer: No Defense Programs supported research has been done at the Stanford Linear Accelerator. Research done at its neighboring, but separately funded "work for others" facility, the Stanford Synchrotron Radiation Laboratory, has long included unclassified basic research by scientists supported under Defense Programs. This research aims at fundamental understanding important to many fields of technology which could include weapons. On the other hand some of the data produced by these weapons-funded researchers appear in widely published tables depended on by academic researchers. The proposed research is similar in that most of it will seek fundamental understanding of broad applicability and, as in the past, all of it will be unclassified. On the occasions when x-ray detectors will be standardized, they will often be of types useful for not only weapons tests but also other technologies and basic research, including that being done at the Stanford Synchrotron Radiation Laboratory.

Question: Is funding for this weapons-related activity in the FY 84 budget request?

Answer: The FY 1984 Energy Research budget does not include any funds associated with weapons related research at the Stanford facility.

Question: Where is this request - under the high energy physics program or in the defense programs area?

Answer: This activity is not included in the High Energy Physics Program within the Office of Energy Research. I am not familiar with the details of the defense programs budget which is the responsibility of the Assistant Secretary for Defense Programs.

Question: What are your views on proceeding with this work at the SLAC facility?

Answer: The first requirement is that the proposed research meet the quality standards normally required for research at the Stanford Synchrotron Radiation Laboratory: it must pass this scientific peer review. If it does so, I believe that the research being proposed by staff from the Weapons laboratory is entirely appropriate. The research will all be unclassified, which meets the Stanford University requirement for work done at the Synchrotron Radiation Laboratory. The work is qualitatively indistinguishable, to a first approximation, from the spectrum of research, including weapons-related research, long done at the Stanford Synchrotron Radiation Laboratory. The difference in what is proposed, as I perceive it, lies in the fact that Defense Programs money would build the necessary beam line. At the same time, I recognize the strong dependence of the success of the Stanford Synchrotron Radiation Laboratory on the good will and the extra-mile collaboration of many of the staff of the Stanford Linear Accelerator.

Question: If the funding is proposed under the high energy physics program - provide the Committee with a detailed justification for the activity and the total cost including the FY 84 level.

Answer: As I noted earlier, the proposed beam line is not a part of the Energy Research request but is being reviewed by Defense Programs. I am not able, of course, to speak authoritatively for them.

Accelerator Facility Upgrade Projects

Question: Explain the importance of the new accelerator facilities upgrade projects.

Answer: The accelerator facility upgrade projects at Yale University and the University of Washington will strengthen the capacity of two of the Nation's leading universities to conduct forefront nuclear research at on-campus facilities. These upgrade projects are needed to maintain the long term scientific viability of the existing Yale and Washington nuclear research laboratories. In addition to the value of these projects to the overall national basic research effort, the ability to conduct forefront research is essential to attract talented graduate students and to provide them with the best possible training. Both Yale University and the University of Washington have excellent records in the area of basic nuclear research for scientific accomplishment and graduate student training. The projects are technically sound and ready for initiation.

Basic Energy Sciences

Question: Explain the importance of the new Advanced Materials Research Initiative.

Answer: This year, in response to Congressional interest in materials research and in consonance with the President's policy statement, an Advanced Materials Research initiative is being proposed. This new initiative will build upon the base of knowledge established by the Materials Sciences program and other such programs in the Government. It will complement ongoing core program activities, emphasize high risk, high pay-off research with potential for technology transfer, and contribute greatly to United States leadership in the field of materials science.

The National Center for Advanced Materials is proposed as a scientifically logical redirection of the Lawrence Berkeley Laboratory with complementary augmentation of capability at the Stanford Synchrotron Radiation Laboratory. The National Center for Advanced Materials project provides for the construction of four new facilities. They are an Advanced Light Source; a Surface Science and Catalysis Laboratory; an Advanced Materials Synthesis Laboratory; and an Advanced Device Concepts Laboratory. As part of this project funds are also provided for improvements at the Stanford Synchrotron Radiation Laboratory. The project will have to meet a number of important objectives.

First, this initiative will enhance understanding, through long-range basic research, of the synthesis, characterization, and properties of advanced materials in support of U.S. energy-related and high-technology industry. Second, this project will provide a next-generation synchrotron light source for U.S. materials science and engineering research. Finally, this project will provide advanced facilities for research training of additional graduate students in physical sciences and engineering fields vital to U.S. high-technology industry.

In addition, this initiative will provide for the expansion of the National Synchrotron Light Source which will provide added experimental capabilities which will be made available to general users at universities, industry, national, and Government laboratories.

Question: Provide a breakdown of all construction and capital equipment items in the FY 1984 request.

Answer: The FY 1984 budget request provides for total funding of $38.0 million associated with the Advanced Materials Research Initiative. This new initiative will permit the start of construction for two projects: the National Center for Advanced Materials for which $25.9 million is requested, and will permit the expansion of capability of the recently dedicated National Synchrotron Light Source for which $2.5 million is requested. In support of these two construction projects we are requesting $7.7 million in operating funds and $1.9 million in capital equipment funds. This funding will be used to support research associated with construction and to begin to put in place a forefront research program which will take advantage of these new facilities.

Question: What is the total cost and construction schedule for the National Center for Advanced Materials?

Answer: The total estimated cost of the National Center for Advanced Materials is $138.9 million. We plan to start construction in the first quarter of FY 1984 and to complete construction the fourth quarter of FY 1989.

Question: Describe the extent of industry participation in the materials research initiative.

Answer: Industrial and university members of the Council on Chemical Research were given a one-day long briefing of the National Center for Advanced Materials. Several industrial organizations have been sought out and briefed on the project objectives and have been asked to actively participate in the research program. Also, as part of the advanced materials initiative the addition to the National Synchrotron Light Source at the Brookhaven National Laboratory will provide added space and provide new beam lines. The current industrial users are participants in research using these new beam lines. We expect, also, that new industrial users will be forthcoming as the National Synchrotron Light Source program develops.

Heavy Ion Fusion Research

Question: Explain specifically how the $5.0 million requested in Heavy Ion Fusion Research will be utilized?

Answer: A plan has been formulated to develop heavy ion accelerator technology to the point where decisions can be made on application of the technology to inertial fusion for civilian energy needs. Most of the funds provided in FY 1984 will be utilized to conduct research and development on critical elements of accelerator technology. Specifically, these elements are accelerator design and development, including induction linac module development, advanced multibeam studies, and injector subsystem design; and heavy ion beam transport and focusing, including demonstration experiments on a single beam line constructed for this purpose. In addition to these program elements, a portion of the funds will be used to study beam interaction with matter, including detailed comparison of calculations with experimental data on cold matter. In this connection, it is expected that new experiments will be performed at the Lawrence Berkeley Laboratory BEVALAC facility as recommended by a recent JASON study panel. The principal laboratories involved in the above effort are the Lawrence Berkeley Laboratory and the Los Alamos National Laboratory.

Question: Why was this activity transferred from Defense Programs, and is this a logical place for this activity?

Answer: The Assistant Secretary for Defense Programs and the Director of the Office of Energy Research have agreed that the heavy ion accelerator research program is primarily applicable to long-range inertial fusion research for civilian energy needs. This agreement is also in accord with Congressional Conference Report 97-342, dated November 18, 1981, with prohibits the use of defense inertial fusion funds for "... research ... of heavy ion devices... ." Moreover, the near-term programmatic requirements of the heavy ion method indicate strong emphasis on advanced accelerator development, appropriate to the Office of Energy Research. For all of these reasons, the indicated transfer is desirable and logical. In connection with the transfer, a new National Plan was formulated. A recent JASON study panel concluded that "The proposed National Plan for HIF seems to be a sensible and minimal next step in Heavy Ion Fusion."

Question: Is this the entire ICF-civilian effort within DOE?

Answer: The Heavy Ion Fusion Research program is the principal activity in the DOE which is directed exclusively at the application of an inertial fusion method for civilian energy needs. However the Inertial Fusion program conducted under the guidance of the Assistant Secretary for Defense Programs has dual applicability, long-term energy research as well as near-term weapons physics research. For example, target design and experimental target research performed under the Defense Program would be required for any inertial fusion program, civilian energy or defense-related. It would therefore be inappropriate to characterize the Heavy Ion program as the only inertial fusion program aimed at civilian energy needs. In addition, the Defense effort includes a small subprogram in fusion reactor system studies and component development, both of which contribute to the long-range civilian energy objective.

University Research Support

Question: What portion of the high energy and nuclear physics budget for FY 84 goes to support university research and how does this compare to each budget for the last 5 years?

Answer: The following table is a breakdown of direct support of university-based research as a percentage of total Operating Expenses and as a percentage of Total Budget in the High Energy Physics program and in the Nuclear Physics program. Over the FY 1979 to FY 1984 period, direct Operating Expenses to universities is a relatively constant fraction at about 18 percent for High Energy Physics and at about 25 percent for Nuclear Physics. The annual variations in fraction of Total Budget in Nuclear Physics are due to the presence or absence of specific construction projects at on-campus accelerator facilities. This table does not include support provided to university user scientists through the national accelerator facilities in the form of beam time and other services essential to conduct of experiments at the national facilities by university user scientists.

Fraction of Direct Support to University Research

	FY 1979	FY 1980	FY 1981	FY 1982	Estimate FY 1983	Estimate FY 1984
High Energy Physics						
Oper. Exp.	17.8%	18.1%	17.3%	17.5%	17.5%	17.9%
Total Budget	13.3%	13.4%	13.2%	14.3%	14.8%	14.2%
Nuclear Physics						
Oper. Exp.	25.1%	26.1%	24.8%	25.3%	25.6%	24.9%
Total Budget	22.5%	28.3%	28.1%	25.8%	24.1%	27.3%

If the table is revised to include estimates of indirect support provided through the national accelerator facilities, then the fraction climbs to nearly 80 percent of the total High Energy Physics program and nearly one-half of the total Nuclear Physics program.

Fraction of Direct Plus Indirect Support to University Research

	FY 1979	FY 1980	FY 1981	FY 1982	Estimate FY 1983	Estimate FY 1984
High Energy Physics						
Oper. Exp.	79%	80%	79%	79%	79%	80%
Total Budget	78%	78%	78%	79%	79%	79%
Nuclear Physics						
Oper. Exp.	46%	47%	46%	46%	47%	47%
Total Budget	47%	51%	50%	48%	48%	50%

Magnetic Fusion Energy

Question: Can you give us an indication of when, in your view, we will have a scientific demonstration of fusion energy?

Answer: The Tokamak Fusion Test Reactor (TFTR) facility which was recently completed at the Princeton Plasma Physics Laboratory has been designed to demonstrate the scientific feasibility of magnetic fusion energy release. The experimental program leading to this demonstration began this year with the production of the first plasma in the device and is expected to achieve energy breakeven by about 1986; the generation of as much fusion energy as was required to heat the fusion plasma.

Question: When will we be close to commercial application of fusion energy?

Answer: It is difficult to be precise about when the goal of commercialization will be achieved because of a number of factors outside of our direct control such as economic, budgetary, and social issues. However, we believe that our current program is designed to provide the foundation of scientific and engineering knowledge for a private sector decision on fusion's commercial application around the turn of the century.

Question: Would you explain what impact, if any, your policies and changes in program direction are having on the fusion program?

Answer: The Department's policy regarding Magnetic Fusion Energy is to seek to demonstrate the scientific and engineering feasibility of nuclear fusion. This then would provide the information for a commercialization decision on fusion applications. The Department also intends to maintain the U.S. leadership in the area of magnetic fusion energy research and development. This is being done by conducting a balanced scientific program of research and associated technology development involving various fusion plasma confinement concepts. In this decade we are emphasizing those programs which will provide the information needed to select a plasma core concept for a reactor from the two leading concepts; long-pulse tokamaks and tandem mirrors. Also receiving emphasis are those base scientific and technology development tasks which will allow us to define an attractive reactor, based on the chosen concept.

Question: Your FY 84 budget request has a $31 million increase in operating expenses for the magnetic fusion program. Please explain the need for this increase.

Answer: The Magnetic Fusion Energy budget request for operating expenses is $392.7 million. This represents an increase of $24,100,000 or about 6.5% over the recently agreed to FY 1983 funding level for fusion. This is partially offset by a decrease of $21,500,000 in construction funding and a $1,700,000 decrease in capital equipment funding. What these numbers portray is the fact that several construction projects have been recently completed or deferred. As new projects are completed and operations are initiated there is a resultant increase in the requirement for operating funds. A second factor to consider is that some of the basic cost elements, such as power and labor, continue to increase thus forcing the cost associated with conducting the ongoing base scientific and technology program upwards. Finally, the third factor in explaining the budget increase is associated with the fabrication of auxilliary hardware required for the Mirror Fusion Test Fcility - B project. Recognizing the important role that this facility will have in providing critical data for the concept selection process in 1988, it is essential to maintain the schedule for completion of this project in 1987. Therefore the budget request for Mirror Fusion Test Facility - B includes an increase of about $12,000,000 in operating expenses over the FY 1983 level to allow this component fabrication work to proceed on schedule.

Question: Your budget supports the technological development of the two mainline concepts — tokamaks and tandem mirrors, as well as further work on alternative concepts. When will we move to select or further concentrate our fusion efforts?

Answer: A major goal of this program is to select a concept in this decade for use as the fusion plasma core in an advanced engineering development device that will be used for demonstrating engineering feasibility. Steps are being taken this year to explore the scientific and technological issues which need to be addressed prior to a concept selection decision. As I indicated previously, the completion of the Mirror Fusion Test Facility - B project is one of many key projects which is required in order to provide information required for this decision. In addition, alternate concepts are no longer being pursued as alternative reactor lines. In accord with one of the Magnetic Fusion Advisory Committee recommendations, research on alternate concepts is being conducted to provide a more complete scientific base for the mainline concepts.

Question: Explain your reasons for proposing termination of the effort on the EBT-P project.

Answer: The decision to terminate further work on the Elmo Bumpy Torus, Proof-of-Principle project was based on recent physics research results which revealed uncertainties in the fundamental scaling assumption. A detailed review by a panel of technical experts has verified this. Based on this, we decided it was inappropriate to proceed with construction of the Elmo Bumpy Torus Proof-of-Principle project at this time. We intend to conduct further investigations with the existing facilities to clarify these underlying issues.

Question: Provide the Committee with a status report on the FMIT project. Do you anticipate international cooperation on the project?

Answer: The Fusion Materials Irradiation Test Facility at Richland, Washington, is continuing in FY 1983 to complete development tasks and component design details in preparation for eventually proceeding to the construction phase. The design of the building and utilities is complete and ready for construction. Supporting R&D is more than 80% complete. The experimental lithium system is being operated to test the lithium target and to develop the in-line lithium chemistry system. Design work and associated support is being completed on the experimental system. Tests are beginning on the 2 million electron volt accelerator front end which includes the newly developed ion injector and radiofrequency quadrupole.

It has been recognized that there is only a need for one such facility in the world-wide fusion community and therefore we feel that this provides an excellent opportunity to pursue international collaboration in a joint international project to construct and operate such a materials test facility.

A review has been initiated by the International Energy Agency of the fusion materials program and the specific role of this project. The initial review has produced a highly supportive response. Upon completion of the report we expect to receive an expression of intent by mid-July from Canada, Japan and Europe.

Biological and Environmental Research

Question: Provide a breakdown of all activities within this program and the reductions from the FY 1983 level.

Answer: The breakdown follows.

	(BA in thousands)		
	FY 1983 Estimate	FY 1984 Request	Change
Human Health Research..........	$ 25,690	$ 24,429	$- 1,261
Health Effects Research in Biological Systems............	56,075	51,887	- 4,188
Environmental Research.........	25,440	22,595	- 2,845
Physical and Technological Research......................	29,132	25,989	- 3,143
Carbon Dioxide Research........	9,000	12,000	+ 3,000
Health and Environmental Risk Analysis.................	1,750	0	- 1,750
Nuclear Medicine Applications..	18,500	21,000	+ 2,500
Program Direction..............	3,350	3,600	+ 250
Total Operating Expenses.....	168,937	161,500	- 7,437
Capital Equipment..............	11,677	7,700	- 3,977
Construction...................	2,000	1,000	- 1,000
Total Biological and Environmental Research......	$182,614	$170,200	$-12,414

Chairman HATFIELD. We are very grateful for your time and your appearance today. I think this may be a good moment to break for a vote. I will return for the continuation of the hearing. Thank you.

Dr. TRIVELPIECE. Do you want me to remain as a witness?

Chairman HATFIELD. You may leave if you wish. The other witnesses will remain so that they can continue after I return.

Dr. TRIVELPIECE. Thank you, Senator.

Chairman HATFIELD. Thank you.

[A brief recess was taken.]

ENVIRONMENT, SAFETY, AND HEALTH PROGRAM

STATEMENT OF WILLIAM A VAUGHAN, ASSISTANT SECRETARY, ENVIRONMENTAL PROTECTION, SAFETY AND EMERGENCY PREPAREDNESS

ACCOMPANIED BY ROBERT W. DAVIES, DEPUTY ASSISTANT SECRETARY FOR ENVIRONMENT, SAFETY, AND HEALTH

PREPARED STATEMENT AND BIOGRAPHICAL SKETCH

Chairman HATFIELD. Thank you, Mr. Vaughan, for your patience in this matter. We have your full statement and biographical sketch which will be placed in the record, and certainly, you are now welcome to proceed to highlight or summarize it as you wish.

[The statement and biographical sketch follow:]

STATEMENT OF WILLIAM A. VAUGHAN, ASSISTANT SECRETARY, ENVIRONMENTAL PROTECTION, SAFETY, AND EMERGENCY PREPAREDNESS

Mr. Chairman and members of the Subcommittee, I am pleased to be here today to discuss with you the Department's budget request for FY1984 for the Environment, Safety and Health Program. With me to assist in responding to your questions is Robert W. Davies, the Deputy Assistant Secretary for Environment, Safety and Health.

INTRODUCTION

The Environment, Safety and Health Program (ES&H) provides an independent overview and assessment of the Department's management of contractor-operated facilities to assure safe and healthful workplace conditions, the safety and health of the public, protection of the environment, and compliance with applicable ES&H-related statutory and regulatory requirements in the Department's facilities and operations. The program also assures that energy issues compatible with national energy goals are considered in the development of proposed environmental requirements.

Achieving the Department's environmental, safety and health protection and quality assurance objectives hinges on a solid partnership between the Environment, Safety, and Health Program and the Department's line programs. The ES&H Program furnishes the line programs with applicable ES&H requirements through general policy orders, monitors their efforts in complying with these requirements, and assists with technical advice in resolving implementation problems. This allows the line programs, which have the principal responsibility for safety, to proceed with greater assurance that they will not incur interruptions from accidents, public controversy, or litigation stemming from non-compliance with ES&H-related laws or sound ES&H practices.

PRINCIPAL LEGISLATION

The principal legislation to which the ES&H Program responds are the DOE Organization Act which establishes, as an organizational purpose, a Departmental goal of protecting and enhancing environmental quality and assuring public health and safety; and the Atomic Energy Act which exempts DOE and its contractors from licensing and regulation but requires the Department's operations to be conducted in accordance with comparable health and safety practices. In addition, the National Environmental Policy Act requires consideration of environmental factors in agency decisionmaking which often results in the preparation of environmental assessments and enviromental impact statements.

ORGANIZATION

The Environment, Safety and Health Program is organized and carried out by five major components: Nuclear Safety, Quality Assurance and Standards, Operational Safety, Environmental Compliance and Environmental Analysis. Their activities involve the development of policies and standards; oversight to monitor program and field office performance in complying with DOE policies and standards, technical and policy guidance assistance, as needed, to foster compliance; the review of National Environmental Policy Act documents, and the analysis of energy/environmental issues. The principal focus of the ES&H Program has been recently sharpened to emphasize more strongly safety, health protection and quality assurance in the Department of Energy's nuclear operations. The refocusing began as a result of a Departmental examination of safety lessons learned from the Three Mile Island incident that could be applied to the operation of DOE nuclear facilities.

This program is essential to the continued effective operations of the nuclear energy and defense programs of the Department of Energy.

FUNDING

In FY 1984 we are requesting $40.4 million for the Environment, Safety and Health Program which is $1.4 million more than in FY 1983; but, there is an even greater change in emphasis, primarily in the priority placed on nuclear safety in DOE operations, as can be noted in the following table.

Funding Summary
(Budget Authority in Millions)

Environment Safety and Health	FY 1983 Request	FY 1984 Request
Operating Expense:		
Nuclear Safety	$10.4	$13.5
Quality Assurance and Standards	1.7	0.9
Operational Safety	16.5	14.8
Environmental Compliance	1.5	1.6
Environmental Analysis	2.0	2.6
Program Direction	5.4	5.4
Subtotal	37.5	38.8
Capital Equipment	1.5	1.6
Total ES&H	$39.0	$40.4
Staffing - Full-time equivalent	111	95

FY 1983 ACCOMPLISHMENTS

The FY 1983 and FY 1982 planned and actual accomplishments include:

- Conducted the first comprehensive environmental protection, safety and health protection appraisal of four Departmental Field Operations. The comprehensive appraisals consist of performing appraisals in approximately ten functional areas in conjunction with, and as input to, a management appraisal of the organization being appraised.

- Developed guidance to define the scope and content of fundamental training for operators of DOE reactors.

- Provided technical expertise and assistance to field offices and line safety organizations in the review of safety analyses, and interpretation and guidance on Departmental policy for environmental protection, safety, and health protection for nuclear facilities and operations.

- Initiated expansion of Atmospheric Release Advisory Capability (ARAC) to cover all DOE nuclear facilities, and continued coordination with Department of Defense for application of ARAC to nuclear weapons sites in the United States. Attained a 30 minute ARAC response to emergencies at DOE and military sites.

- Completed fire protection surveys at five DOE installations and completed guidelines for optimum fire management systems.

- Continued medical care and radiological monitoring of Marshall Islands people; and continued processing radiation dosimetry records at the Nevada Test Site.

- Completed a baseline quality assurance overview of principal DOE programs, and established quality assurance guidelines for major projects and systems acquisitions within the Department.

- Performed analyses of NEPA documentation requirements for proposed Departmental actions, and developed NEPA compliance strategies for major programs such as nuclear waste disposal. Completed 130 independent reviews of NEPA documents prepared by DOE organizational units. Major Environmental Impact Statement reviews included the Pantex Facility Expansion, the Northeast Regional coal conversion activities, the Purex facility restart, and a number of Uranium Mill Tailings remedial action projects. The practical result of this work was to insure that NEPA requirements were met, thereby protecting the Department's projects from delay and unnecessary cost due to non-compliance with the National Environmental Policy Act.

- Analyzed energy-related costs and benefits of proposed changes to the Clean Air Act and Clean Water Act and assessed the impacts on DOE facilities of proposed modifications to these Acts.

- The ES&H policies and independent overview have helped the Department to continue its excellent record of safety, health protection, and evironmental compliance at the Departmental operational facilities. For example, the latest Annual Report on Environment, Safety and Health at DOE facilities issued in October 1982 shows:

  -- That with minor exceptions the concentrations of routine radioactive releases from the departmental facilities continue to be undistinguishable from the natural background levels and that unusual occurrences consisted of only minor releases of radioactivity.

  -- Despite the large scale of the Department's activities, the safety record continues to be substantially better than that of private industry with respect to fatality and illness incidence rates, lost workday cases, and property and motor vehicle loss. For example, based on the U.S. industrial companies average rate of 13 fatalities per 100,000 employees, DOE could expect as many as 19-20 deaths annually. However, in FY 1982, DOE experienced one-third that number, or six fatalities. Of these six, five occurred in transportation accidents and one from a fall during facility construction - DOE experienced no fatalities in FY 1982 involving the actual onsite operation of its facilities.

FY 1984 OBJECTIVES

In FY 1984 the Program plans to continue the overview and assessment efforts of departmental activities to assure management that environment, safety and health policies are fully implemented and practiced in DOE's operational activities. The principal objectives in FY 1984 include:

- Develop training guidance for reactor and nuclear facility operators to improve operational safety at DOE nuclear facilities.

- Maintain a viable radiological emergency response capability for DOE facilities.

- Develop improved methods for internal radiation dose assessments, to assure compliance with radiation exposure limits recommended by national and international authorities.

- Develop improved methodologies for assessing the safety of nuclear operations.

- Issue revised environmental protection, safety and health protection guidance and conduct appraisals of ES&H performance at four of the eight Operations Offices.

- Issue quality assurance and unusual occurrence reporting guidance and appraise implementation of the guidance at eight field or program offices.

- Assist DOE organizational units in preparing sound NEPA documents for their actions, and perform reviews of all such required documents, so as to facilitate Departmental programs.

- Analyze proposed regulations and statutes, such as modifications to the Clean Air and Clean Water Acts, to ascertain the potential impact on DOE programs or interests.

SUMMARY

The Environment, Safety and Health Program to date has assured that national energy policies and departmental plans, programs and operations have effectively addressed and expeditiously resolved environmental and safety problems; and the proposed FY 1984 budget request provides the resources to continue the independent Environment, Safety and Health overview of Departmental operations and activities.

I am prepared to answer your questions or comments on this program.

BIOGRAPHICAL SKETCH OF WILLIAM A. VAUGHAN

William A. Vaughan was nominated by the President on June 15, 1981, and confirmed by the Senate on September 18, 1981, as Assistant Secretary for Environmental Protection, Safety and Emergency Preparedness, U.S. Department of Energy (DOE). In this position, Mr. Vaughan is responsible for ensuring that the Department's programs are in accord with national environmental, health, and safety regulations. In addition, he directs DOE's energy emergency and contingency planning efforts and has responsibility for the Naval Petroleum Reserves, the Oil Shale Reserves, and the Strategic Petroleum Reserve.

Mr. Vaughan was Director of Energy Management for General Motors Corporation (GM), since 1976. From 1971 until 1976, he was Attorney-in-Charge, Environmental and Energy Law Section. Mr. Vaughan joined GM's Legal Staff as an attorney in 1970. During his tenure with GM, he taught courses in environmental law and energy law at the University of Detroit.

From 1960 to 1970, Mr. Vaughan was on the faculty of Virginia Military Institute (VMI), initially as an instructor and then as an Assistant Professor of Civil Engineering. During the period 1964 to 1967, he served as Deputy Commandant of Cadets at VMI. He currently holds the rank of Colonel in the U.S. Army Reserves, having served on active duty from 1957 to 1960.

Mr. Vaughan received a B.S. degree in civil engineering with honors from VMI in 1957, an M.S. degree in civil engineering from Purdue University in 1964, and a J.D. degree, magna cum laude, from Washington & Lee University Law School in 1970. He was Editor-in-Chief of the Washington & Lee Law Review and a member of the Order of the Coif.

He is a Registered Professional Engineer in Virginia and is a member of both the American and Michigan Bar Associations. Mr. Vaughan was also a member of the Energy Steering Group and Chairman of the Coal Utilization Subcommittee for the National Association of Manufacturers, on the Steering Committee for the Process Gas Consumers Group, served on the Energy Council for the American National Standards Institute, and has represented GM on the Electricity Consumers Resource Council. He was named "Man-of-the-Year" by Modern Industrial Energy magazine in May 1980.

Mr. Vaughan was born in Richmond, Virginia. He is married and has three children.

September 1982

BIOGRAPHICAL SKETCH OF ROBERT W. DAVIES

Robert W. Davies has served as Deputy Assistant Secretary in the Office of Environmental Protection, Safety, and Emergency Preparedness since November, 1981. He is responsible for managing the Department's environmental programs, nuclear safety, operating facilities safety, and the quality assurance and standards programs.

Prior to joining the Department of Energy, Mr. Davies had been employed by the Baltimore Gas and Electric Company since 1950, where he was engaged in work related to the design, construction and operation of the Company's electric generating plants. In 1960 and 1961, he spent 18 months working with General Atomic in San Diego, California, on the design of the nuclear portion of the No. 1 Unit of the Peach Bottom Atomic Power Plant. From 1962 to 1966, he was project Engineer for the No. 3 Unit installation at the Herbert A. Wagner Power Plant. He became Chief Mechanical Engineer in 1966 and was responsible for project administration and for the mechanical and nuclear engineering design of the Company's new electric generating plants, including the Calvert Cliffs Nuclear Power Plant.

Mr. Davies was appointed Manager of the Quality Assurance Department in September, 1972. In this capacity, he was responsible for developing and implementing quality assurance programs for all safety-related activities associated with the Company's nuclear power plants. In November, 1978 he was appointed Manager of the Brandon Shores Project, a 1200 Mw coal burning plant in Anne Arundel County. The two 600 Mw generating units are scheduled for commercial operation in 1984 and 1988, respectively. In January, 1980, Mr. Davies was placed on special assignment as Manager of the Nuclear Review Project to conduct an independent, corporate-wide review of the Company's nuclear operating and support capability.

Mr. Davies received a B.S. degree in mechanical engineering from Texas A. & M. University in 1947, an M.S. degree in mechanical engineering from The John Hopkins University in 1950, and obtained his nuclear education at the Oak Ridge School of Reactor Technology in 1955-56.

He is a Registered Professional Engineer in Maryland and is a member of the American Society of Quality Control, American Society of Mechanical Engineers and the American Nuclear Society.

Mr. Davies was born in Fort North, Texas. He is married and has two children.

SUMMARY OF BUDGET REQUEST

Mr. VAUGHAN. Mr. Chairman, I, too, am pleased to be here to discuss with you the Department's budget request for fiscal 1984 for the environment and health and safety program.

Chairman HATFIELD. Excuse me. Would you also introduce your colleague?

Mr. VAUGHAN. With me to help in responding to any questions you might have, is Mr. Robert W. Davies, the Deputy Assistant Secretary for Environment, Safety, and Health.

This program, specifically, the environment, safety, and health program, provides an independent overview and assessment of the Department's contractor-operated facilities to assure safe and healthful workplace conditions, the safety and health of the public at large, the protection of the environment, and compliance with applicable environment, safety, and health-related statutory and regulatory requirements in our facilities and our operations.

The program also assures that energy issues compatible with national energy goals are considered in development of proposed environmental and safety and health requirements.

Achieving the Department's environmental, safety, and health protection and quality assurance objectives hinges on a solid partnership between the environment, safety, and health programs and the Department's line programs. The ES&H program furnishes the line programs with applicable technical guidance through general policy orders; monitors the program efforts in complying with these requirements, and assists with other technical advice in resolving implementation problems.

This allows the line programs, which have the principal responsibility for safety and health, to proceed with greater assurance that they will not incur interruptions from accidents, public controversy, or litigation stemming from noncompliance with environmental, safety, and health-related statutes and regulations.

Briefly, this program is organized into five major components: Nuclear safety, quality assurance and standards, operational safety, environmental compliance, and environmental analysis. Their activities involve development of policies and standards, oversight to monitor program and field office performance in complying with DOE policies and standards, technical and policy guidance assistance as needed to aid and foster compliance, the review of National Environmental Policy Act documents, and, as I said, the analysis of energy-environmental issues.

The principal focus of the environment, safety, and health program has been recently sharpened to more strongly emphasize safety, health protection, and quality assurance in the Department of Energy's nuclear operations. The refocusing is a result of a departmental examination of safety lessons learned from the Three Mile Island incident that could be applied to the operation of DOE nuclear facilities.

FISCAL YEAR 1984 BUDGET REQUEST

Just in a very sketchy outline, the President's fiscal year 1984 budget request for this activity is $40.4 million. This is a $1.4 million increase over the fiscal year 1983 request.

The principal activity of assuring safety and health at operating facilities and environmental compliance of applicable projects will continue, and there will be an increased emphasis on safety at departmental facilities. The increased emphasis on safety will include: Development of training guidance for reactor and nuclear facility operators to improve operational safety; maintaining a viable radiological emergency response capability at the DOE facilities; developing improved methods for internal radiation dose assessments to assure compliance with radiation exposure limits recommended by national and international authorities; and, finally, developing improved methodologies for assessing the safety of nuclear operations.

The environment, safety, and health program to date has assured that national energy policies and departmental plans, programs, and operations have effectively addressed and expeditiously resolved environmental, health and safety problems, and the proposed fiscal year 1984 budget request provides the resources to continue the independent environment, safety, and health overview of departmental operations and activities.

POLICY AND MANAGEMENT

Finally, I would like to mention another budget line item under this committee's jurisdiction; namely, that of policy and management for my entire organization.

The Department's budget request of $900,000 is to fund 19 full-time equivalent staff-years for my immediate Office and the administrative Office of Management Service. This request is one-third less than our present staff level of 29 full-time equivalents. We are actively trying to diminish our staffing in those areas scheduled to go down, and that includes administrative areas as well.

LNG SAFETY TESTING FACILITY

An item that is not included in my statement for the record, Mr. Chairman, involves fiscal year 1983 funding for a liquified natural gas safety testing facility. This item was not requested by my Office, nor was it requested by the Department; nor was it included in the President's budget submission. It was inserted in the budget in the House. It provides for $3 million of funding for the creation of a liquified natural gas testing facility at the Nevada Test Site.

There are several things about this item, in addition to the fact that the Department did not request it, that I would like to point out to you.

One, in my judgment, $3 million could not scratch the surface of creating an adequate facility; second, to site it necessarily at the Nevada Test Site, it seems to me, is to be premature. Inadequate work has been done to date to properly site such a facility.

Perhaps the most important point, certainly from my program's point of view, is that while the House inserted this funding request, it caused some deductions to be made elsewhere in the budget, and that could cost us in the area of nuclear safety, an area which this entire program is very tightly budgeted for. It is adequate, but it cannot, in my judgment, share reduced funding at the expense of some other activity. I intend to bring this to the House Appropriations Committee hearings' attention in my testimony Thursday of this week, and I am bringing it to your attention now.

Without further adieu, Senator, I am available for questioning.

Chairman HATFIELD. Is the LNG facility to which you have just referred a one-time expenditure?

Mr. VAUGHAN. I find it very difficult to believe, Senator, that it could be a one-time expenditure given the on-going operating costs of the facility, once built. What we are discussing here is the creation of a test facility to test explosive materials such as liquified natural gas, and $3 million, in my judgment, wouldn't scratch the surface.

ESTIMATED COST OF FACILITY

Chairman HATFIELD. What would be the estimated cost of such a facility?

Mr. VAUGHAN. Senator, while I believe this project existed in the budget several years ago, I have seen no such recent estimates. It was phased out last year and the test activity turned over to the private sector. We are just now completing, within the next 30 to 60 days, the transfer of the data from the tests conducted at other development facilities in the late seventies, in 1980 and 1981, and we have not requested funding for the continuation of this program.

As I say, we did not make a request this year nor ask for continuation of this program. So we have made no estimates for the creation of this facility.

Chairman HATFIELD. I am not necessarily an advocate of the project, but you are going to face the House subcommittee, and there are some strong feeling about this item over there. I would urge you to at least do some preliminary review of costs, because I would assume that if the cost factor were reasonable, and if it could be locked into a one-time expenditure by some kind of a written agreement, or it was to be reimbursed, would you, at that point, then, consider that it is a worthy project or that it would be an acceptable project?

Mr. VAUGHAN. I think, Senator, that properly run through the budget process with adequate planning and adequate study, one perhaps could properly develop such a facility and capability. A basic question needs to be asked, which this administration has asked and answered earlier, of whether this needs to be done by the Federal Government. We were not persuaded that it should.

In fact, we were persuaded that it was a proper subject for the private sector and could be transferred.

We have expended money in the past year and a half to take the data of previous tests and put it in proper format so that it could be turned over to the private sector for whatever future the private sector deemed appropriate.

We saw no appropriate role for the Federal Government in this area.

SAFETY QUESTIONS FOR LNG OPERATIONS

Chairman HATFIELD. Are there bona fide environmental, safety, and health questions involved in LNG operations?

Mr. VAUGHAN. There are primarily bona fide safety problems, Senator, but the use and importation of LNG is a matter of companies making application to the FERC; for example, for a certificate for the sale and introduction of LNG into the gas systems. At the time those applications are made to the FERC and State and local authorities, the applicant, in the past, has had the burden of assuring the safety.

We, frankly, see no compelling case to make that a Federal Government responsibility.

If I may, Senator, I think the reason that this program existed in the past was that the previous administration had great plans for the role of LNG in the Nation's energy supplies for the future, and frankly, this administration does not see such a grand scale for LNG.

Chairman HATFIELD. I appreciate your explanation. I am troubled a bit, and I think you are going to face greater difficulty on the House side. I am not an advocate, necessarily, because I am, frankly, not that much of an expert on this item. But I think there are a lot of earmarks related to joint Government-private sector activities. I'm not sure that the Government, at the Federal level, can ever divest itself of safety research. That is inherent in the whole role of the Federal Government in the field of safety. It is not something that I think you can delegate to States. We have had troubles in the past where the Federal Government has had to pick up the pieces.

If you think there are legitimate and bona fide safety problems involved here, then it seems to me it is an ideal example of the Government and private sector operation consistent with the administration's view of transferring programs to the private sector because, as I understand it, it was to be a reimbursed, one-time expenditure only, and if that is not true, then, of course, I am misinformed.

But if it is, and even though you may question the figure, I hope that you don't reject this out of hand if there are legitimate, bona fide safety problems that might be involved in LNG. I think that is a basis on which the House moved.

Mr. VAUGHAN. In the discussions of transferring the data from the private sector, from which funding and testing have already been run for the past several years, we went out of our way, Senator, to make clear that we were willing to entertain the proper proposals and work cooperatively.

However, shall I say it seemed to me that the manner in which it was introduced into the budget by its proponents is not the proper way to go about that. It is likely to lead to excess expenditures and not a planned process and so on.

PROCESS OF CONGRESSIONAL EARMARKING

What we find here, for example, is a situation that comes essentially out of the blue, no cost estimates have been prepared by us, and it comes as a total surprise rather than coming up through the program.

Chairman HATFIELD. Do you mean, Mr. Vaughan, that the fact that Congress added an amendment to or changed your budget is not the proper budget procedure?

Mr. VAUGHAN. Certainly, the Congress can fund and have the administration do things if it desires. I am aware of little to no testimony or investigation that led to that funding; certainly a bare minimum from us. In fact, it would have been what little bit of discussion there was a year ago.

Chairman HATFIELD. On the other hand, you don't have the data to present that would contradict or refute those assumptions made in that proposal. As I understand it, you had not developed such data.

Mr. VAUGHAN. I'm not aware of what the specific proposal is. The only thing I can tell you, Senator, is that there is a sum and a command to locate a facility at the Nevada Test Site. That is pretty sketchy guidance, and I don't think we will end up with a properly put together program.

[A discussion was held off the record.]

DIFFICULT ROLE IN ENVIRONMENT, SAFETY, AND HEALTH

Chairman HATFIELD. Mr. Vaughan, I want to thank you. I think you people have a very difficult role at this particular time and in many other emergencies. I am very impressed with you, with your credentials and your colleagues', and I thank you for coming here today.

We will work with you to resolve any problems or issues that we may have on your budget request. I assure you of a totally open door from our staff and our committee at any time.

ADDITIONAL PREPARED QUESTIONS FOR THE RECORD

We do have additional questions which I will submit to you in writing for the record. We also have questions from Senator Mattingly of Georgia that we will also include in the record for your response.

[The questions and answers follow:]

QUESTIONS SUBMITTED BY SENATOR HATFIELD

Marshall Islands and Related Sites

Question: Explain your ongoing activities and responsibilities with respect to residual studies undertaken as a result of the U.S. nuclear weapons testing program.

Answer: The Department of Energy is responsible for the radiological monitoring of personnel and the environment in the Marshall Islands, sites of the atmospheric nuclear tests; and providing followup medical care for the people of Rongelap and Utirik who were injured by fallout March 1, 1954, as mandated by Public Law 95-134, Territories, of the U.S. Appropriation Authorization Act dated October 15, 1977. The above serves as the basis for continuing the dose assessment analysis related to people living on, or considering return to, contaminated atolls. DOE functions in an advisory capacity to the Department of Interior and the Department of Defense regarding radiological assessements in order for them to fulfill their responsibilities. To accomplish this program, the DOE maintains a research vessel at Kwajalien and a logistics contractor in Honolulu, Hawaii.

DOE activities with regard to the offsite Nevada Site populations exposed to fallout include the determination of distribution and levels of fallout; performing radionuclide pathway analyses and the development of dose models to estimate external and internal radiation exposures. In addition, several hundred cubic feet of documents have been declassified and housed in a public information center, the Coordination Information Center, in Las Vegas, Nevada. The Dose Assessment Advisory Group provides advice to the Secretary of Energy and the Manager of the Nevada Operations Office regarding the direction of this program.

Question: Provide a breakdown for the record of your request in this area as well as other agencies.

Answer: The Department of Energy request for FY 1984 is $6 million. The breakdown is as follows:

Marshall Islands Program	FY 1983	FY 1984
	(In Thousands)	
Medical Followup	$1,143	$1,143
Radiological Monitoring and Assessments	1,951	1,951
Logistics	1,051	1,056
Sub-total	$4,145	$4,150
Nevada Offsite Dose Reassessment	1,400	$1,400
Program and Policy Support Studies	855	450
TOTAL	$6,400	$6,000

We have contacted the other federal agencies involved in health and medical support in the Marshall Islands and will furnish the data to the Committee as soon as available.

Question: Where will the reduction from FY 1983 be made and what is the justification for this cut?

Answer: The reduction in funding of $400,000 in FY 1984 is due to the cutback in several technical projects performed by DOE laboratories to support the EP medical and radiological monitoring and dose assessment activities in FY 1983 as shown in the above table.

LNG Safety Program

Question: American Gas Association and the Gas Research Institute, I believe, made a proposal last spring for a one time DOE expenditure that would enable industry to assume responsibility for LNG Safety research. The DOE would even be reimbursed for that one time expenditure. Why has it taken so long to respond and will you respond positively? When?

Answer: The Department made a decision as part of the FY 1983 budget to close out the LNG safety testing, to document the results of the testing, and to make the data available to industry. When the LGF Spill Test Facility was propsed to DOE in March 1982 we were considering the FY 1984 budget and it was decided that the Department of Energy would not support this project in the FY 1984 budget. Considering the action taken by the Congress to fund this project as part of the FY 1983 Continuing Resolution, I believe it would be mutually beneficial if we prepare a report for the Congress on the proposed project and associated testing program, including its cost and the method to be used by industry to reimburse the government through user fees. A report will be submitted to the Committee within 90 days.

Question: What is being done to assure that the technical capability (R&D Team) developed at great expense by DOE is kept viable while the spill facility is being built? How much FY 83 and FY 84 money do you intend to devote to assure smooth transition and retention of a viable technical team?

Answer: It is my understanding that the R&D team at LLNL has been maintained to date from prior year funds for closing out the former LNG testing program and may be maintained in the future by cooperative funding from the gas industry. No DOE funding was requested in the FY 1983 or the FY 1984 budgets submitted to Congress for this purpose.

Question: Congress requested that you complete construction of the spill test facility at the Nevada Test Site. What has been done to implement this? When will construction begin?

Answer: In association with the development of updated cost estimates for the report referenced above, conceptual and preliminary design will be undertaken along with projected construction schedules. A decision on construction cannot be determined until the reports's findings have been completed.

Question: The concept of a National Spill Safety Test Center allowing industry access to the expertise and resources of the Lawrence Livermore National Laboratory and the Nevada Test Site on a reimbursable basis seems like an ideal example of Government/Industry cooperation consistent with this Administration's views on transferring programs to the private sector. Do you agree?

Answer: Given assurance that the project will proceed on a reimbursable basis including the follow-on operating expenses, it could serve to benefit both industry and government objectives in the safety area. However, as testified previously, we believe the responsibility for LNG safety clearly rests with the private sector.

Nuclear Safety Activities

Question: Explain the need for the increase requested for nuclear safety.

Answer: The increased request for nuclear safety is to continue the orderly enhancement of our independent oversight of the safety of the Department's nuclear operations. This effort was started in FY 1982 after completion of an intensive in-house assessment of lessons applicable to our nuclear operations that we could learn from the Three Mile Island accident. One of the principal conclusions of that assessment was that we should strengthen our independent oversight capability. Strengthening it requires that appropriate levels of both outlay and staffing resources be provided as discussed below. We are still in the building process.

Question: Provide a breakdown for the amount in FY 83 and FY 84 for each activity within the Nuclear Facility Safety and Radiological Controls subprogram.

Answer: Strengthening the independent oversight function has involved increased emphasis and resource dedication for both of our subprograms. For radiological controls, the additional $1,575,000 will support improvement of radiation detection instrumentation and enhancement of our emergency response capability. The additional $1,550,000 for nuclear facility safety will be dedicated to increasing and improving nuclear facility operator training, and reviewing the Department's nuclear facilities to identify problems and associated corrective actions in order to strengthen and improve overall facility operations. A table follows:

Nuclear Safety
($in thousands)

	FY 1983	FY 1984
Nuclear Facility Safety		
Operator Training Standards	$620	$1,050
Generic Safety Technology	$640	$1,100
Analysis of Operations	$1,740	$2,400
Subtotal	$3,000	$4,550
Radiological Controls		
Radiation Protection	$1,375	$2,250
Emergency Response	$6,000	$6,700
Subtotal	$7,375	$8,950

Question: Do any of these activities duplicate NRC efforts?

Answer: None of these activities duplicate NRC efforts. However, many of them are complementary efforts closely coordinated with the NRC and other Federal and State and local agencies. Our emergency response capability constitutes a national resource which the NRC and State and local governments have called on during nuclear emergencies, e.g., Three Mile Island. Coordination of NRC's nuclear safety research and licensing technical support performed at DOE facilities is a function carried out by my office. Through this coordination function we maintain a real time awareness of NRC's safety outlay programs and benefit from these efforts which have applicability to DOE's nuclear operations.

QUESTIONS SUBMITTED BY SENATOR MATTINGLY

Pantex Plant EIS

Question: Your statement mentions as one of DOE's major accomplishments the EIS review on the Pantex Facility. Did the expansion of the plant include the operation of a nuclear reactor? Was that a "full-blown" EIS?

Answer: The Pantex Plant, near Amarillo, Texas, is primarily a weapons assembly facility, and does not involve the operation of a nuclear reactor. The Pantex draft environmental impact statement (EIS), issued in December 1982, was prepared to evaluate the impacts of continuing operations and constructing additional facilities at the Pantex Plant. Proposed new construction would nearly triple the number of assembly bays and the size of the production facilities by FY 1988. The content of the EIS meets the requirements of the National Environmental Policy Act, and includes an analysis of a range of alternatives to the proposed action, including relocation of some or all of Pantex operations to other existing or new facilities.

L-Reactor at Savannah River

Question: I am sure you are aware of the proposed restart of the L-Reactor at the Savannah River Plant and the initial environmental impact assessment made by DOE? Are you also aware that Senator Thurmond and I held a public hearing in Augusta on February 9, and following that hearing we have requested a more complete and thorough environmental impact study?

Answer: Yes, I am aware of the proposed restart of L-Reactor and the environmental assessment that was prepared in support of that project. I am also aware of the hearing held in North Augusta on February 9, which was attended by my Deputy Assistant Secretary for Environment, Safety, and Health, Mr. Robert W. Davies. I have been advised of your proposed extended public review process to alleviate any remaining public concerns. We believe the proposal has merit and we are giving it careful consideration.

Question: Mr. Vaughan, can you give this committee any estimate regarding the additional costs involved in complying with the four steps, Senator Thurmond and I outlined in the February 28 letter.

Answer: I have been advised by the Office of Defense Programs that the extended public review process, including four public hearings and the preparation of responses to comments received, would cost less than $250,000.

Question: Doesn't it seem reasonable that DOE should undertake an environmental impact study for the SRP reactor restart which is even more intensive than that conducted for the expansion of the Pantex Facility where no reactor operations were involved?

Answer: The preparation of the L-Reactor environmental assessment (EA) did involve an extensive technical and analytical effort. The L-Reactor EA does, in fact, provide a sufficient analysis of the impacts of restarting the reactor. All major substantive issues which have been raised on this matter were addressed in the EA. DOE followed the Council on Environmental Quality regulations in complying with the National Environmental Policy Act and determined that an EIS is not required.

SUBCOMMITTEE RECESS

Chairman HATFIELD. We will have our next hearing on Thursday at 2 p.m. on the Nuclear Regulatory Commission and the Federal Energy Regulatory Commission.

The hearing is recessed.

Mr. VAUGHAN. Thank you.

[Whereupon, at 3:15 p.m. Tuesday, March 8, the subcommittee was recessed to reconvene at 2 p.m. Thursday, March 10.]

ENERGY AND WATER DEVELOPMENT APPROPRIATIONS FOR FISCAL YEAR 1984

THURSDAY, MARCH 17, 1983

U.S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Washington, D.C.

The subcommittee met at 2:17 p.m. in room SD–116, Dirksen Senate Office Building. Hon. Bennett Johnston presiding.

Present: Senator Johnston.

DEPARTMENT OF ENERGY

ATOMIC ENERGY DEFENSE ACTIVITIES

STATEMENT OF HERMAN E. ROSER, ASSISTANT SECRETARY FOR DEFENSE PROGRAMS

ACCOMPANIED BY:

- **RICHARD L. WAGNER, ASSISTANT TO THE SECRETARY OF DEFENSE (ATOMIC ENERGY)**
- **TROY E. WADE II, PRINCIPAL DEPUTY ASSISTANT SECRETARY FOR DEFENSE PROGRAMS**

INTRODUCTION OF WITNESSES

Senator JOHNSTON. The hearing will come to order.

At the request of Chairman Hatfield, I am conducting the hearing this afternoon, and welcome to it. The purpose of the hearing is to receive testimony on the fiscal 1984 budget proposal for the atomic energy defense activities within the Department of Energy. First, we will hear from Herman E. Roser, Assistant Secretary for Defense Programs at DOE, and Dr. Richard L. Wagner, Assistant to the Secretary of Defense for Atomic Energy. Our next principal witness will be Adm. Kinnaird R. McKee, Director of the Naval Nuclear Propulsion Program.

PREPARED STATEMENTS

On behalf of the subcommittee, we welcome you and your colleagues. Your full statements will be included in the record for all witnesses. So please proceed to summarize as you like.

[The statements follow:]

STATEMENT OF HERMAN E. ROSER, ASSISTANT SECRETARY FOR DEFENSE PROGRAMS, DEPARTMENT OF ENERGY

INTRODUCTION

Mr. Chairman and Members of the Committee, I am pleased to present the Department of Energy's Fiscal Year 1984 budget request for the Atomic Energy Defense Activities under my direction. I plan to discuss the Weapons Program, which includes funding for Inertial Fusion; Verification and Control Technology; Nuclear Safeguards and Security; Security Investigations; and Materials Production and Defense Waste and Byproducts Management.

I have with me today my Principal Deputy, Mr. Troy Wade, along with my three Deputies: Major General William Hoover who directs our Military Application program, including Inertial Fusion; Mr. James Culpepper who has responsibility for Verification and Control Technology, Nuclear Safeguards and Security, and Security Investigations; and Dr. F. Charles Gilbert who directs the Materials Production and Defense Waste and Byproducts Management programs.

To provide a framework for my statement, let me briefly review the mission of the programs under my direction.

- We are responsible for the design, testing and manufacture of all U.S. nuclear weapons.

- We are responsible for producing all of the nuclear materials required for the weapons program and manage the resulting nuclear wastes.

INTENTIONAL
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- We are charged with the task of developing the inertial fusion technology in support of the Nation's military needs, and as a possible future energy supply technology.

- We support verification of international nuclear arms control agreements and control of sensitive technology and equipment exports.

- We ensure the protection, control and accountability of special nuclear materials and the protection of DOE facilities.

- And, we control the dissemination of classified information.

(Chart 1) Our Defense Programs organization is as shown on this diagram.

The work we must perform in Fiscal Year 1984 is prescribed by or flows from, the 1983-1988 Nuclear Weapons Stockpile Memorandum. This annual Presidential directive governing the production and retirement of all U.S. nuclear weapons is developed jointly by the Departments of Defense and Energy, is carefully reviewed by the National Security Council and is finally approved by the President. The Stockpile Memorandum is a balancing of the military judgements of the Joint Chiefs of Staff, requirements flowing from programs of cooperation with Allied governments, the delivery system deployment requirement of the Military Departments, the Department of Energy production capabilities, and budgetary considerations. As such, its development is complex and rigorous, requiring extremely careful consideration by high level officials at each step in the process.

[Deleted.]

[Deleted]. It should be noted, however, that over a several year period, the number of weapons in the stockpile is not increasing since the retirements of older weapons from the stockpile are substantially equal to the new production. The total yield of the stockpile has not been increasing, and in fact has been decreasing slightly in recent years due to retirements of older, higher yield weapons.

Rather than a "build-up" of the stockpile, the Departments of Defense and Energy are engaged in a long overdue modernization of the United States' strategic and tactical forces, as well as the Intermediate Nuclear Force of the North Atlantic Treaty Organization. This modernization will enhance the safety and security characteristics of our weapons, and it will strengthen the credibility of our nuclear deterrent, providing a very important backdrop for our ongoirg arms control and weapon reduction negotiations.

[Deleted.]

Increased materials production and processing creates a need for more waste management capability. At the same time, we are moving forward toward permanent disposal of our transuranic and high level wastes.

Additional to these expanding production activities is the continuation of the major effort in restoration and refurbishment of our plant and equipment for weapons manufacture, materials production, and waste management. In FY 1984 we are requesting funds to begin revitalization of our weapons testing facilities.

In summary, we are in a very demanding situation. We are called upon to produce more weapons in FY 1984 [deleted] [deleted] Simultaneously, we must manage our nuclear waste, prepare for its permanent disposal, rebuild much of our existing plant capability to rectify the effects of aging and insufficient maintenance, and upgrade some of our safeguards and security systems.

To many, this would seem an insurmountable set of tasks; however, their overriding importance to the security of this nation makes it imperative that we accomplish our goals. I believe this program has the most talented, dedicated, and highly motivated personnel that can be found anywhere. The contractor management and staff of our laboratories, test sites, production and processing plants and our federal employees in Headquarters and the field offices, are without equal. I am confident that with your help in providing the financial resources, we will continue to supply the nation's requirements for nuclear weapons safely, efficiently, economically, and on a timely basis.

(Chart 2) In order to perform the work I have just outlined, our FY 1984 Defense Programs budget request is for $6.165 billion, which compared with our allowance in FY 1983 of $5.177 billion is an increase of 19%.

I will address each major component in some detail.

WEAPONS ACTIVITIES

(Chart 3) The largest part of our weapons work is the Production and Surveillance function. Next is the Research, Development and Testing of new weapons systems. Then comes our Inertial Fusion activity, and finally, Program Direction. This is the smallest in terms of dollars, but of course it is absolutely essential.

The weapons program task is large, complex and important in our national defense structure. It includes three major laboratories doing work in theoretical and experimental nuclear and classical physics, mathematics, chemistry, hydrodynamics, metallurgy and other materials sciences, electronics, engineering and other such disciplines necessary for the design, testing, development and ordnance engineering of nuclear weapons. A large, remotely located test site is necessary for underground nuclear explosive tests for both development and stockpile reliability purposes. A manufacturing complex is required with a spectrum of very demanding capabilities including fine watch making, heavy machining and fabrication of parts made of plutonium and other metals, high explosives, foam rubber and plastics. Microelectronics manufacture and even parachute fabrication are also required. Much of this work is at the very forefront of technology, and all of it must meet the most demanding standards of quality control, industrial safety, environmental responsibility, and security.

(Chart 4) These facilities are located as shown on this map. We are assisted in the management of these installations by the Department's Albuquerque, Nevada, Oak Ridge, Savannah River and San Francisco Operations Offices, and an exceptionally capable group of contractor organizations.

As I touched on briefly a moment ago, the specifics of what weapons we are to develop and build, the quantities and schedule for their delivery to the Department of Defense, the schedule and quantities of weapons to be retired from the stockpile, and the schedule for necessary retrofit work is coordinated between the Departments of Defense and Energy through the Military Liaison Committee. These detailed requirements are then documented in the annual Stockpile Memorandum and approved annually by the President, as required by the Atomic Energy Act of 1954, as amended.

PRODUCTION AND SURVEILLANCE

The production facilities for manufacture of U. S. nuclear weapons consists of seven Government-owned, contractor-operated facilities in various locations around the country. [Deleted.]

(Chart 5) The Rocky Flats plant near Golden, Colorado, fabricates and assembles our plutonium parts and performs retirement disassembly and chemical clean-up of recovered plutonium for recycle. The Atomics International Division of Rockwell International is the operator.

(Chart 6) The Kansas City, Missouri, Plant, operated by the Bendix Corporation, manufactures electrical and mechanical components and performs most of our work with adhesives, rubber and plastic material.

(Chart 7) In Miamisburg, Ohio, the Mound Facility is run by the Monsanto Research Corporation. Detonators, explosively actuated timers, initiators and transducers are manufactured here.

(Chart 8) The Y-12 Plant in Oak ridge, Tennessee, is operated by the Union Carbide Corporation and fabricates components from enriched as well as depleted uranium and lithium salts.

(Chart 9) The Savannah River Weapons Facility near Aiken, South Carolina performs extraction, purification and enrichment of tritium, recovers tritium and [deleted] Dupont is the contractor.

(Chart 10) Located near St. Petersburg, Florida, the Pinellas Plant is operated by the General Electric Company. Neutron generating devices, small radioisotopic thermoelectric generators, speciality capacitors and switches and similar electronic parts are made here.

(Chart 11) At the Pantex Plant in Amarillo, Texas, high explosive parts are fabricated and weapon assembly is accomplished. Also, repair, disassembly, disposal and stockpile surveillance testing are done here. The Mason and Hanger - Silas Mason Company is the contractor.

The work load is increasing in each of these facilities, as we are tasked to build larger numbers of more sophisticated weapons.

(Chart 12) The increase in our production effort, in standardized equivalent units of workload, is shown on this chart. These data are the most pertinent since they take into account the differences in difficulty and complexity among the several weapons systems we are producing and include the work necessary in any given year in preparing for future production.

NEW PRODUCTION

The following weapons will be in production in FY 1984:

The B-61 Mod 3 and Mod 4 bombs
W-76 Trident warhead
W-79-1 8-inch Artillery Fired Atomic Projectile
W-80-0 Sea-Launched Cruise Missile Warhead
W-80-1 Air-Launched Cruise Missile Warhead
B-83 Modern Strategic Bomb
W-84 Ground Launched Cruise Missile Warhead
W-85 Pershing II Missile Warhead

PRE-PRODUCTION ACTIVITY

[Deleted]. I requested on February 15, 1983, approval of the Committee to obligate $40 million of the $60 million included in the FY 1983 appropriation for continuing resolution of PEACEKEEPER warhead production facilities [deleted].

(Chart 13) This chart displays the nuclear weapons build schedule to support deliveries to the Department of Defense called for in the latest Presidential Stockpile

Memorandum. You can see that builds are significantly above where they were a few years ago. An alternate build schedule is being developed to reflect the $99 million Congressional reduction in operating funds in the FY 1983 budget request.

To show some examples of the types of work needed to produce these weapons, please let me show you a few pictures.

(Chart 14) Here is a photograph of a robot used in the production of neutron generators. The robot's arm is holding a component which is being cleaned by an air jet to remove particles. This robot performs a rather tedious job, and is also very cost effective.

(Chart 15) This vugraph shows the machining of high explosives components using numerically-controlled machines at our Pantex Plant in Amarillo, Texas. Once the original setup is made, the operator can move to a remote observation point.

(Chart 16) [Deleted].

PRODUCTIVITY IMPROVEMENTS

The weapons quantity and schedule requirements we face have demanded that we increase the productivity of our production complex. We have taken two major steps to increase our throughput, enabling us to work "smarter", faster, and with fewer mistakes resulting in rejects.

The first step, our restoration program, is familiar to this Committee. This rebuilding of our manufacturing plants' utility systems and replacing obsolete and worn out machinery and other equipment is well along, now in its fourth year of funding. Here are a couple of before and after examples of the effectiveness of the restoration work.

(Chart 17) This chart shows a cooling tower at our Y-12 facility which was obviously in very poor condition. (Chart 18) The next picture shows a new cooling tower constructed at Y-12 as part of the restoration program.

(Chart 19) This chart shows a conventional, manually-operated lathe at our Kansas City plant, which required a highly-skilled operator with years of experience. (Chart 20) This chart shows one of the new Computer Numerical Controlled chucker lathes. This machine has been responsible for a 30% reduction in machining time.

(Chart 21) The introduction of Computer-Aided Design and Manufacture systems which electronically connect our design laboratories and production plants is the second largest complex-wide improvement we are instituting. We are beginning to reap the benefits of this technology in terms of hours of design and drafting time saved, errors in communication avoided, and down time in the plants avoided since automatic machine tool programming is much faster. Many other such improvements are beginning to flow. These I have mentioned are just a few examples.

STOCKPILE MAINTENANCE AND EVALUATION

Stockpile maintenance does not sound very glamorous, but it is indeed a very important function funded under our Production and Surveillance budget. Included in this work is the [deleted] repair, modification, and modernization of older weapons to remain in service at least through the 1980's.

This latter aspect of our work is our Stockpile Improvement effort, incorporating new technology in safety, security and command and control. That testing and inspection work on each system in the stockpile to assure its continuing reliability is known as Stockpile Evaluation.

These maintenance and evaluation efforts are of the utmost importance to the continued reliability of our nuclear deterrent; thus they must be carried out with extreme dedication and care.

BUDGET REQUEST

(Chart 22) The total budget request for Production and Surveillance is about $2.3 billion. Operating expenses are $1.8 billion, Capital Equipment is $114 million and Construction is $443 million.

RESEARCH, DEVELOPMENT AND TESTING

The work constituting our weapons research and development program is conducted largely at the Department's three weapons laboratories - (Chart 23) at Los Alamos, New Mexico, (Chart 24) at the Lawrence Livermore Laboratory in California, and at the Sandia Corporation laboratories with branches in Albuquerque, New Mexico, (Chart 25) and Livermore, California (Chart 26). As I mentioned earlier, these are large, broad-based, multi-disciplined facilities.

Development and expansion of the weapons technology base is an essential part of our research and development. It includes:

[Deleted].

(2) supporting research in electronics, materials, high explosives and similar disciplines;

(3) supporting technology in computers, material fabrication and processing, and work on advanced safety and security systems; and

(4) advanced work in physics, mathematics, chemistry and engineering.

The second major area of the work of the laboratories is the application of the technology base to specific weapon development, engineering, and certification.

Systems which in FY 1984 will be in the development phase prior to manufacture include the W-80-0 warhead for the Sea Launched Cruise Missile, the W-81 warhead for the Navy's standard Missile-2, the W-82 155mm Artillery Fired Atomic Projectile, the W-87 warhead for the PEACEKEEPER Missile, the warhead for the Sentry Missile, and the Trident II warhead. Several other weapons will be in conceptual or feasibility study stages.

Our weapons development effort, in order to be successful in meeting the current weapons needs, must have in hand the results of earlier forward-looking research. It must have ready for application the new physics concepts; the materials characteristics data, and processing and fabrication know how; the new high-explosives technology; and the myriad of advances in electronics, radiation hardening, and other technologies involved in our weapons engineering and manufacture.

(Chart 27) During the 1970's, the funding support of our research and development effort declined in terms of real dollars about 37 percent and about 35 percent in terms of employment, one of the key measures of resources available. These declines forced us to abandon much of our forward research work, which we call technology base effort, in order to focus on the near-term production support requirements. We were living on the results of our research work, and it was wearing thin.

In Fiscal Year 1981, that decline was reversed, and with the help of this Committee, we have begun the climb back. Our goal now is to eventually achieve a level of 8,500 full-time employees in research and development. In FY 1984 our employment will increase to 7,950. This increase will enable more effort in the technology base area which will form the basis for the new weapons of the 1990's.

(Chart 28) Nuclear testing is an integral part of the research and development process. Progress in the laboratory must be tested, refined, tested again, and so on in an iterative fashion. I am afraid that by our treatment of research and development separately from testing in the budget, we have drawn an artificial and misleading barrier between the two, indicating that they somehow are independent. Nothing could be further from the truth.

In the budget decline of the 1970's, the testing activity suffered, as did the advanced work at the laboratories. While the worth of the nuclear testing activity cannot truly be measured by the number of tests we conduct in any given year, this chart does show the fluctuations and general declines in testing. Starting in FY 1981 we have reversed the decline [deleted].

(Chart 29) The real merit of our test explosions is in the performance or diagnostic data that is collected on each shot. With improvements made over the years, we have become able to learn a great deal more from each test and therefore make each one much more valuable than was possible before. The total quantity of diagnostic data -- the key measure of the scope of the testing program -- has risen appreciably in the last few years.

Besides increasing our level of test activity, we also are requesting funds in FY 1984 to begin a major test facility revitalization program in Nevada. Equipment and facilities at the Test Site, many of which originally were of a temporary nature, have become grossly inadequate. This initiative is made up of new facilities; modification, relocation and additions to existing facilities; and new and replacement equipment at the Nevada Test Site, and the

North Las Vegas ATLAS facilities. This is a crucial part of our ongoing upgrade of the research and development effort for which the Department needs the support of this Committee. These pictures show examples of the buildings to be replaced and facilities needing repair.

(Chart 30) The first example shows some of the antiquated living quarters at the Mercury Test Site. These trailers are well beyond their useful life. (Chart 31) The interiors of some of these trailers are in very bad shape, as this photograph shows. (Chart 32) The badly corroded showers in some of the trailers are really unfit for use, and leakage from these showers has also resulted in structural damage to the trailers.

The current total cost estimate of this revitalization work is $600 million spread over five years.

Our RD&T effort is continually developing improved products and techniques for the weapons program.

[Deleted].

(Chart 36) In order to accomplish the work planned for FY 1984, our budget request for Weapons Research, Development and Testing totals approximately $1.4 billion, $1.2 billion in operating expenses, $108 million for capital equipment,and $81 million for construction.

INERTIAL CONFINEMENT FUSION

(Chart 37) A useful complement to the full-scale nuclear testing effort is the inertial confinement fusion program, the concept of which is shown here. Our goal in inertial fusion R&D is to determine the feasibility of using laser and particle beams to ignite and burn very small amounts of fusion fuel. The high temperature, high density conditions of inertial fusion experiments has significance for weapons physics research and weapons effects simulation. Inertial fusion technology has matured to the point that useful weapons-related experiments are a significant part of the inertial fusion programs in the weapons laboratories. (Chart 38) We are requesting $127.1 million for operating expenses, $11.8 million for capital equipment, and $12.9 million for construction. This funding will permit us to continue a five-year plan which entails completing the three major facilities under construction in this program and operating them in the middle to late 1980's. These facilities will represent capabilities both for more effective weapons-related experiments and for developing the data base required for the long-term development of inertial fusion energy applications.

(Chart 39) At Livermore, the two-beam NOVETTE glass laser system has just been brought into operation. It will serve both to demonstrate the short wavelength laser technology of NOVA, of which it comprises two beams, and to support both weapons concept and fusion scaling experiments. The initial experiments on the NOVETTE schedule are related tc

[deleted] NOVETTE will

be operated until its components are required for the final assembly of NOVA. NOVA is scheduled for operation in mid-1985.

(Chart 40) The Antares gas laser at Los Alamos will be completed by the end of FY 1983 and brought into operation early in FY 1984. Antares will be a major addition to the capabilities of the laboratory to support weapons research and development and to contribute to the inertial fusion data base.

[Deleted.]

(Chart 41) The final facility to be funded under the ICF five-year plan is the Particle Beam Fusion Accelerator at Sandia, for which we are requesting $12.9 million in the FY 1984 budget. With the scheduled operation of this and the laser facilities in 1987-1988 we expect to be able to determine the requirements for ignition and significant thermonuclear burn, for both weapons-related and potential civilian energy applications of this technology. The major program participants will be supported in both experiments and technology development by the major supporting laboratories, the Naval Research Laboratory, KMS Fusion, Inc., and the University of Rochester.

PROGRAM DIRECTION

The Program Direction account funds a small cadre of Federal employees in Headquarters responsible for overall Defense Programs management and policy direction and for Headquarters management of the weapons and fusion programs; and about 750 federal personnel in the Albuquerque and Nevada Operations Offices who direct the day-to-day contractor activities in the field. Also included is the Community Assistance Program at Oak Ridge and Los Alamos, under Section 91 of the Atomic Energy Community Act of 1955. The statutory purpose of the assistance is to compensate the Los Alamos and Oak Ridge communities for their lack of a normal industrial or commercial tax base and to attract and retain employees at the Federal energy facilities in those communities. This latter point is of great importance to the Defense Programs work at Los Alamos and Oak Ridge.

Our budget request for Program Direction is just under $56 million.

Now let us turn to the Verification and Control Technology program.

VERIFICATION AND CONTROL TECHNOLOGY

The United States has a vital interest in the degree to which other nations observe their obligations under several nuclear weapon-related treaties. These include the 1963 Limited Test Ban Treaty, which in effect limits weapons tests to underground emplacement and detonation; the 1968 Non-Proliferation Treaty, which obliges the weapons states to work toward nuclear disarmament and obligates non-weapon states to forego nuclear weapons themselves; and the Threshold Test Ban Treaty (TTBT) of 1974 which limits the yield of United States and Soviet tests to 150 kilotons maximum. While the TTBT is not yet ratified by the U.S., both sides have pledged to adhere to its provisions.

(Chart 42) The purposes of the Verification and Control Technology program are to support the United States efforts in monitoring the activities of other nations relevant to these international agreements; to provide the Department's technical expertise in the application of export controls on sensitive nuclear technology and other items of national security concern as required by the Nuclear Non-Proliferation Act, the Export Administration Act and other regulations and Executive Orders; to support ongoing arms control negotiations, policy formulation and certain intelligence activities; and to meet the Department's intelligence requirements.

Activities within the Verification and Control Technology program fall into two functional categories -- detection technology and analytical support, both of which draw upon the unique expertise, skills and resources of the national nuclear weapons laboratories.

NUCLEAR DETECTION TECHNOLOGY

The detection component of the program encompasses a wide range of technologies related to the detection of nuclear weapons activities -- spaceborne sensors, seismic and nonseismic detection, debris collection, sample analysis, and other scientific efforts.

SPACEBORNE SENSORS

Our space effort develops and maintains U.S. capability to detect [deleted] nuclear explosions from spaceborne platforms' [deleted].

The effort

includes research and development, the actual fabrication of sensor packages, and operational support, including analysis of data collected.

(Chart 43) In FY 1984 the Department will continue to furnish nuclear explosion detection subsystems, but in larger numbers than previously, for the Global Positioning System, [deleted] and other Defense [deleted] satellites, in accordance with delivery schedules coordinated with the Department of Defense [deleted]

[Deleted.]

SEISMIC DETECTION

DOE's seismic research program is fully coordinated with other agencies having similar responsibilities, [deleted] and the Defense Advanced Research Projects Agency. The aim of the program is to determine the effectiveness of regional -- that is, short-range -- seismic signals for monitoring compliance with nuclear test ban treaties. Such regional seismic monitoring would augment teleseismic -- that is, long-range monitoring, aiding in distinguishing nuclear explosions from other seismic events and measuring their yield. Teleseismic monitoring is a function of the Atomic Energy Detection System, which is managed by the Air Force [deleted] Regional data would be integrated into the Atomic Energy Detection System.

We plan no significant changes in our seismic detection effort for FY 1984. (Chart 45) A main element is the five-station Regional Seismic Test Network deployed in the United States and Canada and linked via satellite to a control point in Albuquerque, New Mexico. The network will continue in operation as a research tool for learning how such an in-country system might be used to monitor compliance with nuclear test ban treaties.

NONSEISMIC DETECTION

The nonseismic detection program also will continue without major change. The program has two main components -- infrasonic monitoring, which would monitor extremely low frequency sound signals, and ionospheric monitoring, which would measure perturbations of the upper atmosphere. The aim of these research and development efforts is to determine whether these techniques can be relied upon as long-range supplementary means of verifying compliance with nuclear test ban treaties. A main purpose is to use the infrasonic or ionospheric signals as a means of distinguishing underground nuclear explosions from earthquakes, thunderstorms, missile launches or other natural or man-made phenomena.

[Deleted.]

ON-SITE MONITORING

The Peaceful Nuclear Explosions Treaty, which along with the Threshold Test Ban Treaty awaits ratification, provides for the United States and the Soviet Union to conduct observations and examinations on each other's territories for certain peaceful nuclear explosions. This on-site monitoring provision is unique in arms control agreements with the Soviet Union, and the United States hopes that someday the on-site principle will be widely applied. The aim is to minimize the chance that a country, under the guise of conducting a "peaceful" explosion, will gain military benefits otherwise banned. If the Peaceful Nuclear Explosion Treaty is ratified, the United States must be prepared to exercise its on-site monitoring rights. The Verification and Control Technology program has developed the necessary equipment and has designated Defense Programs personnel with the necessary skills to participate in an on-site verification team. The FY 1984 funding request will enable the Department to maintain the equipment in readiness.

ANALYTICAL SUPPORT

Analytical support activities fulfill our responsibilities in export control, technology transfer, international scientific exchange, arms control, weapons intelligence and proliferation intelligence. These activities marshal the expertise, data and analysis to take part in formulating and implementing arms control policy, to meet national needs in understanding foreign nuclear weapons programs and nuclear proliferation, and to control the export of weapons-related and energy-related materials and equipment and the transfer of associated technology.

EXPORT CONTROL, TECHNOLOGY TRANSFER AND INTERNATIONAL EXCHANGE

It is our responsibility to review proposed nuclear and energy-related exports, technology transfer, and international cooperation and exchange agreements to ensure that these activities are consistent with U. S. national security and nonproliferation objectives.

Because of the unique experience and resources of the DOE nuclear weapons complex, we also are called upon to support the Defense Department in identifying militarily critical technologies and to support the Departments of State and Commerce in carrying out their important responsibilities for controlling U. S. exports and international cooperation and exchanges.

In the past year we have improved our efficiency in the export control process by increasing use of a computerized suspense and follow-up system. We reviewed approximately 7,500 Commerce export license applications in 1982 and acted on about 85 percent within the initial 30-day period mandated by the Export Administration Act. The remaining 15 percent required additional time because of the need for detailed technical analysis and, in some cases, review by the Subgroup for Nuclear Export Coordination for which the Department provides the Secretariat. The subgroup is an interagency panel established to consider and consult on proposed nuclear exports and related issues.

In addition to dealing with the export review workload, we have been and will continue to be deeply involved in the implementation of a Presidential directive to seek agreement with other nuclear supplier countries on the conditions that should be applied to sensitive nuclear exports.

ARMS CONTROL POLICY AND NEGOTIATION

The Verification and Control program has the primary responsibility for Defense Programs in the arms control arena, participating in the United Nations' Committee on

Disarmament and bilateral and trilateral negotiations on possible nuclear test limitation agreements, participating in the interagency backstopping committees supporting negotiations, and arranging for weapons laboratories scientists to provide technical representation as necessary.

There also are occasional major interagency reviews of arms control policy of direct relevance to the nuclear weapons program. A recently completed review thoroughly examined U. S. policy on nuclear testing limitations, including U. S. positions on existing and future treaties. One conclusion reached was to consider seeking additional measures to make verification of the Threshold Test Ban and Peaceful Nuclear Explosion Treaties more effective. Our arms control experts now are involved in an interagency study to determine what kinds of additional verification measures the United States should propose.

WEAPONS INTELLIGENCE

The Intelligence Community traditionally has turned to DOE and the intelligence elements of the Department's nuclear weapons complex for expertise in the analysis of information regarding foreign nuclear weapons.

[Deleted].

PROLIFERATION INTELLIGENCE

The basic objectives of the proliferation intelligence program are set generally by the Nuclear Non-Proliferation Act of 1978 and more specifically by the Director of Central

Intelligence and the Department's requirements. All reflect the general U.S. determination to impede the spread of nuclear weapons. Specific activities within the program are initiated and pursued in coordination with the Director of Central Intelligence Special Assistant for Nuclear Proliferation. In supporting Intelligence Community efforts to detect and assess foreign nuclear energy and nuclear weapons-related activities, the program relies to a major extent on its access to the skills and experience of the DOE nuclear weapons complex. The proliferation intelligence effort directly contributes to formulation and implementation of U.S. nonproliferation policy; it is also valuable in the negotiating and monitoring of international nuclear agreements and in reviewing proposed nuclear-related exports.

(Chart 46) The Verification and Control Technology request for FY 1984 is $61.7 million, which includes $59.9 million for operating expenses and $1.8 million for capital equipment. The operating expense figure includes $2,750,000 for program direction. The FY 1984 increase of $7.8 million over FY 1983 is attributable to increased deliveries of nuclear explosion detection sensors which ride on various satellites, increased requirements for technical analysis of national security issues related to nuclear weapons, and DOE intelligence responsibilities.

NUCLEAR SAFEGUARDS AND SECURITY

Now, I would like to turn to the Safeguards and Security program.

The mission of the safeguards and security program is to assure adequate protection for nuclear weapons and devices, nuclear materials, facilities and classified information under Department of Energy control and to participate in programs of international cooperation designed to minimize the risk of proliferation of nuclear weapons. Within the Department, the Safeguards and Security organization establishes Department-wide policies and procedures and develops components and systems for assuring such protection. For the most part, the cost of implementing these policies is the responsibility of the appropriate program or facility. The Safeguards and Security program conducts periodic inspections and evaluations of the facilty safeguards and security systems to identify weaknesses and bring about their correction. Our program also provides international safeguards technical support to United States and international activities. The Department's personnel security investigations responsibility, which is an integral part of ensuring adequate protection of resources and classified information, is also carried out through the Office of Safeguards and Security.

The safeguards and security program for which we budget directly supports both operational and developmental activities. Operational activities include the inspection and evaluation function, the improvement of protective forces training and capabilities, technical assistance to field operations, the Nuclear Materials Management and Safeguards System, and the New Brunswick Laboratory. Developmental activities that strengthen safeguards and security are carried out largely by the national laboratories and transferred to the Department's operations. We do not fund the actual plant, capital equipment and operating expenses of agency-wide safeguards and security systems at the Department's facilities. Rather, the safeguards and security systems in the weapons and nuclear materials programs and other Department programs are requested by, budgeted for, and implemented by those programs.

Within this framework and through the activities I will now address, we are endeavoring to achieve and maintain a reasonable level of protection for important Department activities, i.e., a prudent risk level.

The Nuclear Safeguards and Security program consists of five basic elements. These are: safeguards and security operations, technology, international activities, classification and program direction.

SAFEGUARDS AND SECURITY OPERATIONS

Addressing first the safeguards and security operations aspects of our program, I will cover field assistance in the implementation of safeguards and security improvements; security operations; the nuclear material control and accountability operation, which includes the Nuclear Materials Management and Safeguards System; and the

New Brunswick safeguards analytical laboratory at Argonne, Illinois.

Major efforts are required to assure that technology developed to date is transferred and incorporated into the Department's facilities throughout the country. Objectives are to assist operating contractors in applying state-of-the-art technology and cost-effective safeguards systems, and in training for effective operations. These field assistance efforts provide expert technical assistance for cost-effective application of advanced safeguards and security technology, and are focused on the integration of individual components, subsystems, and personnel into complete safeguards and security systems for the Department's facilities. Emphasis is being placed on protection against sabotage and theft of special nuclear material by both insiders and outsiders. To provide assurance that the systems are effective, the program includes use of comprehensive evaluation techniques. The program provides identification of several options in order that the site can select the appropriate option or combinations thereof for implementation based on performance tests, cost, environment, operational impact, and other site-specific considerations. A priority effort called the Safeguards and Security Improvement Program is underway at the Department's production sites requiring improvements.

Current work aimed at improving our protective force capabilities will continue. We believe the continuation of tactical training, application of newly revised physical fitness requirements, and the realism and objectivity in our training exercises afforded by use of the MILES

(Multiple Integrated Laser Engagement System) weapon systems provide for consistency and a high degree of excellence in guard force performance. Our protective force complement of more than 2,500 personnel will benefit from the major improvements in training and effectiveness evaluation.

The program will continue to provide the Department's field elements with timely intelligence information relating to current and changing threats to our activities. Through guidance and technology we will improve our capabilities to neutralize adversarial attempts to interfere with communications or to penetrate information processing systems.

We will continue to manage the comprehensive technical and psychological assessments of communicated threats. These evaluations are intended to provide timely operational judgements and recommendations to the Department's Emergency Action and Coordination Team, the U.S. Nuclear Regulatory Commission, the Federal Bureau of Investigation and other law enforcement agencies in real-time emergency situations involving malevolent threats to nuclear facilities or involving the use of nuclear materials.

Our Nuclear Materials Management and Safeguards System is the single national nuclear materials computerized data base for tracking the location of nuclear materials in the U.S. Annually, approximately 700,000 nuclear material transactions, such as shipments, receipts, and inventory changes, from 130 contractors and 1,400 licensees are entered into the system.

We support the New Brunswick Laboratory, located at the Argonne National Laboratory, which serves as the U. S. Government's safeguards analytical laboratory providing materials and services to the Department, the Nuclear Regulatory Commission and other government agencies, and commercial, industry and foreign organizations. The measurements, standards and inventory verification services fulfill safeguards requirements essential for the control and accountability of nuclear and related materials.

SAFEGUARDS TECHNOLOGY

Research and development provides us with a base of technology to be used in safeguarding Department and other U. S. nuclear facilities. Included is a testing capability for new or modified commercial products, such as sensors and detectors, and analytical methods or capabilities for assessing safeguards and security weaknesses and specifying strategies for improvements. Efforts are directed toward the development and testing of new technology, components and systems for entry control, intrusion detection, explosives detection, use-denial, detection-surveillance-assessment for airborne threats, and advances in security systems to determine effectiveness against new or changing threats.

We coordinate these activities very closely with the research and development efforts of the Nuclear Regulatory Commission and Department of Defense in order to avoid duplication, and advanced technology is routinely transferred to the Department of Defense to assist them. We periodically explore the feasibility of joint research efforts that would be of mutual benefit.

INTERNATIONAL ACTIVITIES

Our international safeguards program supports U. S. nonproliferation and national security objectives. The requested level will permit continuation of the highest priority efforts. These include development of cost-effective international safeguards, which protect sensitive technology from compromise, for application in Gas Centrifuge Enrichment Plants (GCEP). This project includes prototype and on-site testing of the selected safeguards equipment. Safeguards equipment is being developed for International Atomic Energy Agency use at large nuclear fuel cycle facilities, including reprocessing, mixed-oxide fuel fabrication and nuclear power plants using plutonium fuel. Training is provided for foreign safeguards personnel from nations with developing nuclear programs, as directed by the Nuclear Nonproliferation Act of 1978. In addition, we are also actively engaged in exchanging safeguards information with certain countries and are working with trading partners to ensure that U.S.-origin nuclear materials are adequately protected.

Compliance with international agreements and the Atomic Energy Act of 1954, as amended, requires the tracking of both U. S. materials exported overseas and materials of foreign origin in the U. S. We support the tracking of U. S. nuclear material in 50 countries, reporting to the International Atomic Energy Agency (IAEA) under the U.S./IAEA Safeguards Treaty, and determining inventories of nuclear materials under bilateral agreements. Under the Nuclear Non-proliferation Treaty our staff will continue to conduct joint physical security reviews with the Nuclear

Regulatory Commission and the Department of State of U. S. materials exported to foreign countries.

CLASSIFICATION

Funds are included in this request for execution of the Department's program for policy development and implementation for classification of Restricted Data, Formerly Restricted Data, and National Security Information in accordance with the requirements of the Atomic Energy Act of 1954, as amended, and applicable Executive Orders. This program develops and maintains a system of classification guides and approves local classification guides issued by Department field offices and contractors. The program must also assure continuous review of Restricted Data in order for the Assistant Secretary for Defense Programs to determine what may be declassified and disseminated in the interest of science and technology and the general public welfare without damage to the national security. The funding requested for the classification program resources in FY 1984 is $1.15 million, $400,000 more than in FY 1983. The increase is to continue work on establishment of an automated information retrieval system to provide for timely and consistent classification guidance.

SECURITY INVESTIGATIONS

Our program reimburses the Federal Bureau of Investigation and the Office of Personnel Management for conducting background investigations on DOE employees, contractor employees, and consultants prior to their being granted access to classified information or materials or to special nuclear materials, Background investigations are required by the Atomic Energy Act of 1954, as amended, and by Executive Orders 10450 and 10865 to ensure that granting access to classified information, classified material, or special nuclear material will not endanger the common defense and security.

Our budget request provides for approximately 16,700 full-field background investigations and 10,600 National Agency Checks. This is a decrease when compared to the current fiscal year. The majority of background investigations are in support of Defense Programs activities, but also included are Department and contractor personnel in the uranium enrichment and nuclear energy research and development, and other programs.

(Chart 47) Mr. Chairman, we are requesting an appropriation of $52.0 million for the Nuclear Safeguards and Security Program which includes the classification effort and $29.5 million for the Security Investigations Program. With your continued support, we will continue to strive for improvements in the effectiveness of our safeguards and security program.

Now I would like to discuss the Materials Production and Defense Waste and Byproducts Management Programs.

NUCLEAR MATERIALS PRODUCTION

I will begin with the Materials Production program.

The major objectives of the Materials Production program are to provide nuclear materials for National Defense requirements and for our allies under mutual defense agreements; to provide nuclear materials for agency reactor research and development programs, other government agencies, industry, and foreign governments under civilian agreements for international cooperation; and to receive and process nonproduction reactor fuels from the U.S. Naval propulsion reactors, research reactors, materials testing reactors, and various experimental reactors, for recovery of plutonium, enriched uranium, and other materials.

(Chart 48) The primary products of our program are tritium and plutonium to meet U.S. nuclear weapons requirements as given in the Nuclear Weapons Stockpile Memorandum approved annually by the President. The FY 1983-88 Stockpile Memorandum was signed by the President on November 18, 1982, and contains stockpile projections for planning purposes through FY 1998.

The growth in the weapons production requirements shown here is due to the modernization of the United States nuclear weapons stockpile which I discussed yesterday in the context of the Weapons Program.

(Chart 49) To accomplish our objectives, we operate major facilities at several DOE sites, including the production reactor feed plants at Fernald and Ashtabula, Ohio, and Oak Ridge, Tennessee; the N Reactor, a fuel fabrication plant, and site support facilities at Richland, Washington; three nuclear materials production reactors, two chemical processing plants, a fuel fabrication plant, and site support facilities at Savannah River, South Carolina; and a chemical processing plant and site support facilities at Idaho Falls, Idaho. Operations at Idaho include receipt, storage, and processing of fuels both from Navy propulsion reactors and government and civilian test reactors for the cost effective recovery and reuse of the remaining enriched uranium. A fifth production reactor, L Reactor at Savannah River, and a fourth reactor fuel processing plant, the PUREX facility at Richland, are planned to become operational in FY 1984. Lawrence Livermore and Los Alamos National Laboratories conduct advanced research and development activities for the production program.

These sites comprise an estimated 1,850 square miles of land area and employ about 14,000 personnel. The facilities at these sites are unique to the production of nuclear materials for defense purposes. There is no cost effective alternative method available for producing nuclear materials required by the national defense program.

PRODUCTION PROCESS AND MATERIAL FLOW

For the nuclear weapons program, we produce plutonium and tritium in our production reactors. The N Reactor at Richland, Washington is used to produce plutonium. The Savannah River reactors are used to produce both plutonium and tritium.

(Chart 50) The Savannah River reactors use uranium enriched about 60 percent in the isotope uranium-235 in the fuel rods to drive the reactors. Physically separate depleted uranium-238 targets capture neutrons to make plutonium. The depleted uranium target rods are subseqeently chemically processed at Savannah River to recover the plutonium. Tritium is produced in lithium loaded target rods which are placed in the reactor in lieu of the depleted uranium rods. These lithium targets also capture neutrons to produce tritium and helium.

[Deleted].

(Chart 51) The N Reactor on the Hanford site at Richland uses slightly enriched uranium fuel containing about 1 percent fissile uranium-235 in uranium-238 to fuel the reactor and to produce plutonium. The spent fuel from N Reactor is now being stored in water-filled concrete basins at the reactor site pending scheduled reactivation of the Hanford PUREX fuel processing plant in April 1984. (Chart 52)

(Chart 53) The defense nuclear fuel cycle is depicted on this chart. The enriched uranium to fuel our reactors comes from four sources: (1) slightly enriched and highly enriched uranium that is recovered from the reactor fuel itself after it has been irradiated in the production reactors; (2) highly enriched uranium, recovered from spent Navy and R&D reactor fuels, that are processed at Idaho or Savannah River; (3) highly enriched uranium that is stockpiled at the Oak Ridge Y-12 plant; and (4) slightly enriched uranium from the gaseous diffusion plants. Oak Ridge provides uranium of the proper enrichment level for the reactors and ships it to

Savannah River or Richland where it is fabricated into fuel for use in the reactors.

NUCLEAR MATERIAL REQUIREMENTS

(Chart 54)

[Deleted.]

Most of the nuclear materials required for building new warheads is obtained by reclaiming and recycling existing materials from retired weapons which are returned by the Department of Defense to DOE. However, weapon requirements which cannot be met from Department of Defense returns or existing DOE inventories must be satisfied by new production.

[Deleted.]

(Chart 55) Our first materials priority is the production of tritium. Tritium is an indispensable material [deleted] and, due to its natural radioactivity, is constantly decaying at a rate of about 5.5 percent per year. It is vitally important to our nuclear deterrent capability

[deleted].

Even if there were no requirement to produce plutonium, we would still need to produce tritium to maintain our weapon stockpile. (Chart 56) [Deleted.]

(Chart 57) This chart shows how the demand for plutonium equivalent for the current Stockpile Memorandum will be met.

[Deleted.]

NUCLEAR MATERIALS PRODUCTION ACTIVITIES

To produce the material required to meet the Stockpile requirements we are following several courses of action. We will continue to produce the majority of the material to meet requirements in our three currently operating reactors at Savannah River, N Reactor at Richland, and L Reactor at Savannah River, which is scheduled to be restarted in October 1983. Also, blending of high-purity plutonium with supplies of existing fuel-grade plutonium and the use of high productivity Mark 15 cores are important production initiatives to meet requirements. In addition, in the longer term, plutonium isotope separation technology and a New Production Reactor will be needed to meet projected requirements. These activities, along with our other initiatives, will be discussed in the following sections. (Chart 58)

BASE ACTIVITIES

Base activities are those ongoing efforts required to meet the objectives of the program. Base activities include: operation of three Savannah River reactors to produce high-purity plutonium and tritium; operation of the Richland N Reactor to produce weapon-grade plutonium; operation of two processing facilities at Savannah River and one at Idaho; operation of reactor fuel fabrication facilities at Oak Ridge, Richland, and Savannah River; reactor security improvements, including implementation of a rapid material accounting system; increased maintenance of the Savannah River reactors such as P Reactor turbine repairs, and of the Savannah River and Idaho processing facilities; and productivity improvements at N Reactor. The base program also supports processing of the Naval and R&D reactor spent fuel returns in Idaho, recycling scrap nuclear materials to minimize new production, and supporting other DOE and industry requirements. Considerable funding is required for maintenance and equipment replacement to operate these aging faciities in a safe, secure, and environmentally-acceptable manner.

For the first time, the Materials Production budget includes uranium enriching costs for the slightly enriched uranium needed to fuel N Reactor. In prior years, this material was obtained from existing inventories. In FY 1984, however, the proper assay will no longer be in inventory.

The blending program is one of the initiatives started in FY 1981 and is considered part of our base activities. Blending of high-purity plutonium (3% Pu-240) produced at Savannah River with existing fuel-grade plutonium (12% Pu-240) from Richland is the most cost-effective means we have available to us for increasing the near-term supply of weapon-grade plutonium. Blending results in about a 50 percent increase in weapon-grade plutonium production compared to producing weapon-grade plutonium directly. (Chart 59) Since a large DOE inventory of fuel-grade plutonium exists, blending is an attractive method of increasing weapon-grade plutonium production while a plutonium isotope separation capability is being developed. [deleted]. During FY 1984, the first plutonium from the PUREX facility will be received and blended at Savannah River.

PRODUCTION INITIATIVES

Restoration

The Restoration Program is being undertaken to improve the reliability and efficiency of the materials production complex. Most of the production complex has been in continuous use for 25 to 30 years. As a result of aging and use, many facilities, systems, and components have gradually worn out, deteriorated, or become obsolete, causing a decrease in production capability and efficiency.

By 1978 the magnitude of this problem had increased to the point of causing both DOE and Congressional concern. A study was directed at that time to determine what measures were required to restore the production complex to a previous level of productivity and a plan was submitted to Congress in 1979 covering the implementation of all needed corrections. Initial funding of this program, which does not include the Idaho Fuel Processing Facility, was begun in FY 1981.

Restoration construction activities are divided into five authorization phases. Initial funds were provided for Phase I in FY 1981, Phase II in FY 1982, and Phase III in FY 1983. In FY 1984 we will continue this earlier work and initiate Phase IV. This includes funds to complete: replacement of the obsolete plutonium-238 facilities at

Savannah River, N Reactor restoration work at Richland, and reactor fuel handling safety improvements at Savannah River. Phase IV covers additional restoration work required at Savannah River and includes replacement of both reactor and production support equipment. New subprojects will also be added to restore the stoker powerhouses which supply steam and electricity needed for production operations, and modify the Radiological Support Facility which conducts necessary environmental and health analyses. Continued support of this restoration program is vital, since we cannot achieve our production goals without a reliable production complex..

L Reactor Upgrade

The program to upgrade L Reactor was initiated in FY 1981. This upgrading is currently on schedule for completion in FY 1983. FY 1984 will be the first full year of operation of L Reactor. Since the L Reactor was shut down in 1968, many capital projects have been completed to improve the safety and efficiency of the three operating reactors at Savannah River. These changes are being incorporated into L Reactor to bring it to a condition at startup that is equivalent to that of the operating reactors. [Deleted].

PUREX Fuel Processing Reactivation

The FY 1984 budget provides for the funding to continue up to a half year of reactivation activities of the PUREX fuel processing plant and its supporting facilities at Richland, and for a half year of operation. PUREX reactivation is planned for April 1984. [Deleted] we are making every effort to begin PUREX processing as early in FY 1984 as possible. This activity is ahead of schedule and earlier startup appears feasible. PUREX will be used to process irradiated fuel from N Reactor which has been stored since 1972. The stored fuel contains both weapon-grade and fuel-grade plutonium.

High Productivity Mark 15 Cores

The Mark 15 program uses slightly enriched uranium fuel in the Savannah River reactors to provide a uniform core loading that has the potential for significant near-term increases in the level of plutonium production. Our request provides funding to prepare for the conversion of one Savannah River reactor to the Mark-15 mode of operation for part of FY 1985. It also includes funds for the purchase of slightly-enriched uranium from the gaseous diffusion plants for the Mark-15 fuels. Other activities include completion of additional facilities at Savannah River to store Mark-15 fuel and initiating production of Mark-15 fuel at Fernald and Savannah River.

[Deleted.]

Special Isotope Separation

The FY 1984 budget request allows for continuation of the plutonium isotope separation program. Our FY 1984 request is below our FY 1983 appropriation. The decrease reflects the Administration's assessment that a somewhat longer period of research and development is needed before the construction of a demonstration facility. It will enable Lawrence Livermore and Los Alamos National Laboratories to continue experiments begun in FY 1982, support a demonstration of plutonium isotope separation technology on a prototype scale in FY 1986, and will enable the production site to complete the preliminary design of the facilities and equipment needed for a plutonium pilot facility [deleted].

New Production Reactor

The New Production Reactor will eventually be required to assure the production of tritium that is so vital to maintaining our nuclear weapon stockpile. It will primarily be needed to ensure the availability of tritium during the late 1990's and into the next century. Tritium is presently produced in our Savannah River reactors, which are now about 30 years old. We believe it is prudent to design and build a new reactor, as there is an increasing probability over time that the Savannah River reactors could become unuseable. In the decade it will take to design and construct a new production reactor, the Savannah River reactors on which we now depend for tritium will become more than forty years old. The Hanford N Reactor will have to be shut down in the mid-1990's due to distortion of the graphite core. The new reactor would provide a tritium production capability well into the next century. Our FY 1984 budget request provides for activities to support an initial safety review, site characterization, and technology verification activities.

REACTOR SAFETY

Funds are requested to continue activities initiated in FY 1981 to improve the operating safety of our production reactors at Savannah River and Richland. Our objective is to reduce the probability of accidents, enhance safety operations, and improve our capability to manage emergency conditions. Work that will continue in FY 1984 includes increased reactor operator training activities and for modifications to the production reactors to reduce the probability of accidents. Also, at Savannah River, it will provide for construction of a reactor simulator.

SECURITY PROJECTS

We are planning to continue a construction project to improve the security at N Reactor at Richland. We are also continuing two other projects to improve the security of our production reactors at Savannah River and of the Idaho Fuel Processing Facility at the Idaho National Engineering Laboratory.

At Richland, our requested funding for the N Reactor Security and Surveillance project (82-D-118) will provide for completion of Title I and II design.

[deleted].

This project is planned to be completed in FY 1985. For the Savannah River Safeguards Improvements project (82-D-127), our requested funding provides for the completion of modifications [deleted]. This project is scheduled for completion in FY 1986.

[Deleted.]

Now, Mr. Chairman, I would like to turn to the Defense Waste and Byproducts Management Program.

DEFENSE WASTE AND BYPRODUCTS MANAGEMENT

The Defense Waste and Byproducts Management program provides for the management of radioactive wastes generated primarily by the Department's defense activities for the nuclear navy, and for the necessary production of nuclear materials and weapons justified in the testimony on behalf of these other programs. It also includes the development of technologies and facilities for disposal of high-level and transuranic waste from defense activities.

The goal of the Defense Waste and Byproducts Management program is to utilize or dispose of defense nuclear waste routinely, safely, and effectively. In June of this year, the President will forward to the Congress our plans for permanent disposal of high-level and transuranic waste in response to Public Law 97-90. It will show a reasonable and affordable way to meet this goal. By careful evaluation of risks and benefits and through technology improvements, we have reduced the cost of this program dramatically from previous estimates. This reduction in the estimated funding for defense waste management will make more resources available for national needs.

(Chart 60) We are managing the waste safely pending its disposal. The program we propose for fiscal year 1984 continues that job and more: the two major remaining gaps in the defense waste program, demonstration of geologic disposal and immobilization of high-level waste as shown here, are addressed by the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico, and by the Defense Waste Processing Facility (DWPF) at Savannah River, South Carolina. With our fiscal year 1984 funding request, both projects will be under full construction with operations planned for the late 1980's. These facilities will demonstrate effective means for disposal of defense waste and will provide knowledge and experience upon which future defense and commercial programs can build. We expect that by maximizing the utilization of existing facilities and pilot plants, WIPP and DWPF along with a permanent repository, will be the only major capital facilities currently required to permanently dispose of defense waste. Having cut the defense waste tasks down to size, we recommend that these two facilities be constructed as proposed. They will get the job done safely and effectively.

BYPRODUCTS UTILIZATION

We will continue to recover, or retain the option to recover, byproducts for safe and cost-effective beneficial uses.

This recovery can make the management of the remaining waste materials much easier to deal with. For example, we have separated cesium and strontium from the high-level waste at Hanford which allows the remaining waste to go to uncooled storage tanks. At Savannah River, the recovery of strategic noble metals with an estimated value of $30 million will continue to be pursued in the Defense Waste Processing Facility at no cost to that project. In the same project, we also expect to recover and recycle 90 tons of mercury from high-level waste and thus will not have to buy more mercury for production operations at Savannah River. We also plan to recover valuable materials from low-level waste and return them for productive use. For example, at Idaho we can smelt contaminated steel for reuse. We will continue to provide to the Department of Defense with self-luminous lighting and long-lived, secure power supplies. Funding from prior years will allow us to demonstrate to the civilian sector that sewage sludges can be treated with radiation, without introducing any residual radioactivity, and used as fertilizers and even as a food supplement for cattle. Similarly, food can be sterilized without introducing the slightest trace of residual radioactivity. The status of this technology is ready for transfer to the private sector.

REGULATIONS

We are supporting the Environmental Protection Agency and other regulators in developing rational criteria and standards for nuclear waste management, based on real hazards rather than on perceptions or fears, so that we may not waste our efforts but concentrate on the real problems. The Defense Waste and Byproducts Management program will continue to protect workers, public health and safety, and the environment. Our waste management directives comply with the law and provide a level of protection equivalent to Nuclear Regulatory Commission regulations.

WASTE INVENTORIES

(Chart 61) This drawing illustrates the inventories of defense waste. The fuel cycle is closed for the largest inventory, low-level waste, through shallow-land burial. (Chart 62) This illustration shows that 61 percent of the volume of high-level waste, but only 17 percent of the radioactivity, is in the Richland tanks, while 35 percent of the volume and most of the radioactivity is at Savannah River. (Chart 63) Here, we compare the volumes and radioactivity of defense waste with commercial waste. The radioactivity of commercial waste is much greater and much more concentrated than the more dilute defense waste. This trend will continue as indicated on the chart. (Chart 64) These pie charts show that most of the stored transuranic and suspect transuranic wastes, by volume and transuranic content, are at Idaho. Our efforts to dispose of defense waste are concentrated initially on high-level waste at Savannah River and on transuranic waste at Idaho.

The following will describe some recent accomplishments and the plans for fiscal year 1984. I will follow the budget structure as on (Chart 65).

INTERIM WASTE OPERATIONS

The principal objective of this program is to manage existing and newly-generated waste from defense production operations pending implementation of long-term disposal. During fiscal year 1982, the transfer of high-level waste from old tanks to new tanks continued at the Hanford Reservation and the Savannah River Plant. At Hanford, an additional 8 tanks were isolated from the environment and 20 more tanks will be isolated in fiscal year 1983 for a total of 42 out of 149. The program will be completed in fiscal year 1989.

Improvements in the waste transfer program at Savannah River promise to save significant amounts of money in the long-term. Sludge processing in the tank farm was successfully demonstrated in 1982. This has reduced the cost of the Defense Waste Processing Facility by about $200 million. Salt decontamination in the tank farm will be demonstrated in fiscal year 1983. If successful, it will save over $500 million in construction costs for what would have been Phase II of the Defense Waste Processing Facility.

Radionuclides removed from the salt, such as cesium, have potential beneficial uses. The waste transfer program will be completed in fiscal year 1994, which reflects a three year stretchout to effect a more efficient interface between waste preparation in the tank farm and feed requirements in the Defense Waste Processing Facility.

(Chart 66) The New Hydrofracture Facility at Oak Ridge was completed in fiscal year 1982 and began to inject a mixture of intermediate-level waste and concrete into the shale formation under the site. About 350,000 gallons of waste from research programs dating back to the Manhattan Project, will be disposed of in 1983.

(Chart 67) At the Idaho National Engineering Laboratory, the New Waste Calcining Facility started up in September 1982. This facility converts liquid high-level waste into a granular solid, called "calcine," for interim storage in bins. The New Waste Calcining Facility is a critical element of the fuel processing operation at Idaho since there is no significant capacity for lag storage in our facility there. In about six months of operation, the equivalent of one full tank (about 300,000 gallons) of liquid has been solidified, about 17 percent ahead of schedule. The construction of the sixth set of storage bins for calcine, also necessary to insure continuity of productive operations, is on schedule.

As I mentioned previously, we will also be investigating in fiscal year 1983 the feasibility of converting more waste streams into beneficial byproducts. At Oak Ridge, we are considering the cost-effectiveness of smelting almost 100,000 tons of contaminated scrap metal into shielding blocks for use at several of the Department's high energy accelerator facilities. At Idaho, we are evaluating contaminated steel to see if it can be smelted and fabricated into canisters for the immobilized high-level waste from the Defense Waste Processing Facility.

WASTE VOLUME REDUCTION

Waste volume reduction is an important element of the Interim Waste Operations Program because it extends the lifetime of storage and disposal facilities and delays the need for new facilities required to support production operations. At Savannah River, for example, our goal for fiscal year 1983 is to gain seven million gallons of high-level waste storage, the equivalent of about six new tanks, through evaporation. This activity is ahead of schedule. At Hanford, we have accelerated evaporator operations with the goal to free two million gallons of tank space to support PUREX reprocessing operations, which will begin in 1984.

Solid waste volume reduction operations will continue to reduce the need for new burial ground facilities at all of our sites. Segregation and examination of transuranic waste can reduce the amount which must be stored, certified, and eventually transported to and emplaced in the Waste Isolation Pilot Plant. The first quantities of waste were certified for emplacement in early fiscal year 1983. Funds invested in these volume reduction and waste segregation activities will pay off in decreased requirements for disposal and storage facilities and their related operating, closure, and long-term maintenance and surveillance costs. The development and demonstration of waste volume reduction techniques will continue.

The solidification and encapsulation of strontium and cesium at Hanford has made good progress. Our goals for fiscal year 1983 are to produce 70 additional strontium capsules (for a total of 350 out of 660 planned), and to encapsulate the entire backlog of cesium by the end of fiscal year 1983 for a total of 1680 capsules.

In fiscal year 1984, we will continue safe and environmentally acceptable waste activities and support for increased production operations. The transfer of high-level waste from old to new tanks will continue at Savannah River and Hanford. The construction of the sixth set of storage bins for calcine will continue at Idaho with a scheduled completion in December 1984. The construction of eight new double shell tanks begun in fiscal year 1983, and the solidification and encapsulation of strontium from high-level waste, will continue at Hanford. Our goal is to complete the encapsulation of the entire backlog of strontium by 1986 (a total of 660 capsules planned) for safer storage and for potential beneficial use.

During fiscal year 1984, we will also continue to dispose of low-level waste and to store transuranic waste retrievably. We are continuing to prepare for the time when operations at the WIPP will begin. We will complete the development and implementation of procedures to examine newly generated transuranic waste and to certify that it is acceptable for emplacement in the WIPP. Certified waste will be stored separately.

LANDLORD RESPONSIBILITIES

Under our landlord responsibilities, we will continue efforts, begun in fiscal year 1983, to restore badly deteriorated general support facilities and equipment to an acceptable standard of safety, reliability and efficiency. Our goal is to complete the "facilities restoration" part of our landlord responsibilities at Hanford in fiscal year 1988. We are also continuing to support the maintenance, repair and replacement of general site support facilities, such as utilities, roads and service buildings, under our Idaho landlord responsibilities which we assumed in fiscal year 1983.

DECONTAMINATION AND DECOMMISSIONING

The Interim Waste Operations program is responsible for about 400 surplus defense facilities, including reactors, reprocessing plants, and waste management facilities. We emphasize the safe management of these facilities, stressing beneficial reuse of structures, recovery of valuable materials, and reduction of future maintenance costs. In fiscal year 1983, for example, the Curium Facility at Oak Ridge National Laboratory, originally scheduled for decommissioning in fiscal year 1981, was instead decontaminated and refurbished for use in the production of defense nuclear materials. Reuse of this facility resulted in a savings of about $10 million to the taxpayer in new construction costs.

For fiscal year 1984, we will continue to provide surveillance and maintenance of all surplus defense facilities and continue high priority decommissioning work at Idaho, Mound Facility, New Brunswick Laboratory, Oak Ridge National Laboratory, and Hanford with particular emphasis on facility re-use and recovery of valuable materials.

LONG-TERM WASTE MANAGEMENT TECHNOLOGY

This program addresses the long-term management and disposal of defense wastes. The President's plan for permanent disposal of defense high-level and transuranic waste is being drafted and will be implemented under this program.

HIGH-LEVEL WASTE

We are developing the technology for the long-term management of defense high-level waste at DOE sites with emphasis on the Defense Waste Processing Facility at Savannah River. In fiscal year 1983, the work on alternative waste forms was completed and borosilicate glass was selected as the waste form for the facility. The Department has complied with the National Environmental Policy Act regarding the Defense Waste Processing Facility project.

DEFENSE WASTE PROCESSING FACILITY

During fiscal year 1984, we will perform large-scale tests with simulated waste to demonstrate the reliability of the Defense Waste Processing Facility systems, including slurry feed, off-gas, and process controls. Smaller scale tests with actual high-level waste from the Savannah River Plant will continue in hot cells. Together, these tests will assure that the Defense Waste Processing Facility will work as designed. We will also describe and document the predicted behavior of the glass waste form in a geologic repository.

(Chart 68) This facility will immobilize defense high-level waste at Savannah River for storage, transportation, and disposal in a geologic repository offsite. The sludge fraction of the high-level waste, which contains most of the hazardous radionuclides and virtually all of the long-lived activity, will be immobilized directly after extracting mercury. The activity in the soluble salt fraction, primarily radioactive cesium, will be separated and can be used as a beneficial byproduct, possibly in an immobilized form. When the DWPF is operational in fiscal year 1989, we will begin to work off the backlog of high-level waste from production operations at Savannah River, reaching the steady-state operation in about 15 years.

The design, begun in fiscal year 1979, will continue in fiscal year 1983. Major construction activities will begin early in fiscal year 1984, and hot operation in fiscal year 1989. We are requesting $142 million for the DWPF project in fiscal year 1984. This is required to continue design and to enter into subcontracts for excavation, main process building construction, major equipment, construction materials and construction support. The total estimated cost for the DWPF is $910 million, a reduction of $60 million from last year's estimate. This reduction is due mainly to lower inflation estimates and can be sustained if authority is available to enter into major construction subcontracts in fiscal year 1984. If this is done, and if inflation continues to abate, we hope to reduce the total cost even further.

TRANSURANIC WASTE

This program focuses on supporting the Waste Isolation Pilot Plant. The first priority is to certify newly generated waste for the pilot plant if it meets the acceptance criteria. This reduces the growth in the backlog of stored waste that requires examination before it can be sent to the Waste Isolation Pilot Plant or processed for it. Second, the inventory of "old" stored waste will be examined and certified or processed consistent with the Waste Isolation Pilot Plant schedule.

In Idaho, we are completing the final designs for two pilot plants in fiscal year 1983 -- the Stored Waste Examination Pilot Plant to examine and certify stored waste containers for the Waste Isolation Pilot Plant; and the Processing Experimental Pilot Plant to demonstrate processes for treating stored waste containers (Chart 69) that do not meet the Waste Acceptance Criteria. We will also begin testing a new prototype transportation system for transuranic waste and continue to support the certification of contact-handled transuranic waste versus the Waste Acceptance Criteria at all sites.

In fiscal year 1984, we will begin construction on each of the two pilot plants. We will also complete the design and qualification of a canister for remote-handled transuranic waste and begin certifying remote-handled waste, using that canister, by the end of the fiscal year.

We will also start operation of a waste treatment process at the Rocky Flats Plant that will significantly reduce both the sludge volume and the cost of managing that waste.

LOW-LEVEL WASTE

The Low-Level Waste Technology Program supports waste operations at DOE sites. In fiscal year 1983, the technical basis for the DOE Order for waste management operations will be documented. A handbook will document the waste treatment technologies for use by the operators of facilities.

In fiscal year 1984, handbooks are to be developed to document improved practices and procedures for shallow-land burial sites including our experience with barriers against water infiltration and biological intrusion. Corrective measures for old shallow-land burial sites will be documented in a separate handbook.

AIRBORNE WASTE

The Airborne Waste program supports DOE operations in controlling and disposing of gaseous and particulate emissions. In fiscal year 1983 final reports on carbon-14 immobilization, electrofibrous prefilter development, and removal of volatile fission products by thermal outgassing will be completed.

This program will be completed in fiscal year 1984. Final reports on real-time effluent monitoring systems and laboratory support of the High Energy Particulate Air Filter Test Facilities will be prepared.

BYPRODUCTS UTILIZATION

We are demonstrating several beneficial uses of byproduct materials. In fiscal year 1983, we will complete the design and begin construction of the 33 ton per day cesium-137 sludge irradiator in the City of Albuquerque, New Mexico.

Tests and evaluations of remote airfield tritium lights under arctic conditions were successfully completed in January 1983. The Department of Defense' Rapid Deployment Force has expressed particular interest in the use of light-weight, infrared tritium markers in establishing forward tactical attack bases (Chart 70).

During fiscal years 1983 and 1984 (with prior year funds), we will transfer, where possible, the technology of cesium-137 irradiation of sewage sludge and food; self-luminous lighting with tritium and krypton; secure power for strategic and remote applications with strontium-90; and the recovery of noble metals with strategic significance to the private sector. Future efforts will be funded by users of the byproduct materials.

TRANSPORTATION RESEARCH AND DEVELOPMENT

This program seeks to assure that safe, efficient, and reliable transportation will be available for defense nuclear wastes. Technology development, testing, and operational safety and accident analysis are conducted at the Transportation Technology Center at the Sandia National Laboratory in Albuquerque, New Mexico.

(Chart 71) In fiscal year 1983, an instrumented prototype of a new, truck-mounted, transporter (TRUPACT) for contact-handled transuranic waste will be fabricated and tested under regulatory hypothetical accident conditions. Orders for long lead time materials for additional prototype transporter units will be placed in fiscal year 1983. The preliminary design of a new high-level waste cask for trucks will be completed and a prototype unit of a new cask for transport of cesium and strontium capsules from Hanford will be fabricated. This cask will support the use of cesium for irradiation of sewage sludge.

In fiscal year 1984, prototype TRUPACT units will be fabricated and an operational demonstration initiated. The high-level waste cask final design will be completed, a cask model fabricated and tested, and a prototype cask fabricator selected. The first production unit of the new cask for cesium and strontium capsules will be delivered and made available for use. We will continue research, development, testing, and evaluation of nuclear materials transport systems to meet the Department's requirements. We will evaluate the impacts of regulatory changes at the Federal, State, and local levels, develop standards for packaging, and maintain data bases on shipments, incidents, routing, emergency response, and state and local legislation. DOE's Albuquerque Operations Office will continue to be the lead organization for this program.

TERMINAL STORAGE--WASTE ISOLATION PILOT PLANT (Chart 72) The Waste Isolation Pilot Plant project is being developed as a research and development facility to demonstrate the safe disposal of radioactive wastes from national defense programs. The project is exempted from licensing by the Nuclear Regulatory Commission.

The exploratory phase of construction is nearly complete. It includes drilling two deep shafts and extensive exploratory mining at the 2,150 foot level to assess the suitability of the site for radioactive waste disposal. A site validation report will be issued by late March 1983. Construction of permanent surface and underground facilities could start in the summer of 1983, assuming timely receipt of administrative land withdrawal authority from the Department of the Interior.

On December 27, 1982, the Department signed a Supplemental Stipulated Agreement with the State of New Mexico. This Agreement resolved the remaining issues under the State's lawsuit on the project. These issues included transportation monitoring, emergency response preparedness, environmental monitoring, State liability, and highway repair. Good relationships with the State will be a key factor in continuing construction on schedule.

The Administration is supporting the Waste Isolation Pilot Plant project with a fiscal year 1984 request for $81 million. We will also have available $50 million of fiscal year 1983 funds proposed for deferral until fiscal year 1984 for a total of $131 million. The deferral of fiscal year 1983 funds assumes that the Department will experience delays in the receipt of administrative land withdrawal authority which is required by July 1983. If authority is received on schedule, the deferred funds will be released and appropriate changes will be requested for the fiscal year 1984 budget to maintain the program on schedule.

During fiscal year 1984 we expect the Architect-Engineer to complete the design for the pilot plant project. Construction will be nearly at its peak effort. Significant facilities will be completed, including the waste handling shaft, 31 miles of water pipeline, and water storage tanks. The primary waste handling building will be started and extensive underground development will take place. Assuming all project activities continue on schedule, the WIPP facility will be ready for emplacement of radioactive waste in 1988.

SUMMARY

The Materials Production program is directed towards meeting the nuclear materials quantity and schedule requirements implicit in the President's Nuclear Weapons Stockpile Memorandum, and providing for the United States' longer term production needs. To accomplish these ends, we plan to bring to fruition each of the initiatives for production capacity addition as quickly as possible, in a safe, economical manner. Likewise, the Defense Waste and Byproducts program is committed to the safe utilization, handling and disposal of all DOE-generated radioactive wastes. We will continue safe interim storage of defense waste and proceed with efforts to manage waste safely for the long term. We will also assure that our waste operations are adequate to support our increased nuclear materials production program.

This completes my statement on the DOE's Nuclear Materials program. I will be pleased to answer any questions the Committee may have.

DEFENSE PROGRAMS

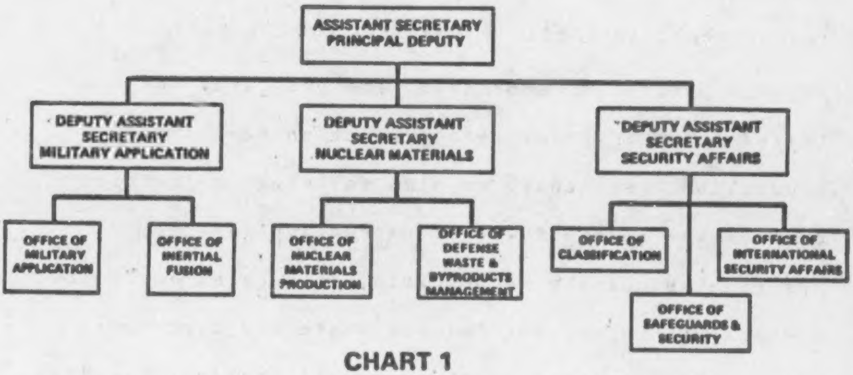

ASSISTANT SECRETARY PRINCIPAL DEPUTY
DEPUTY ASSISTANT SECRETARY MILITARY APPLICATION
DEPUTY ASSISTANT SECRETARY NUCLEAR MATERIALS
DEPUTY ASSISTANT SECRETARY SECURITY AFFAIRS
OFFICE OF MILITARY APPLICATION
OFFICE OF INERTIAL FUSION
OFFICE OF NUCLEAR MATERIALS PRODUCTION
OFFICE OF DEFENSE WASTE & BYPRODUCTS MANAGEMENT
OFFICE OF CLASSIFICATION
OFFICE OF INTERNATIONAL SECURITY AFFAIRS
OFFICE OF SAFEGUARDS & SECURITY

CHART 1

ATOMIC ENERGY DEFENSE ACTIVITIES
FY 1984 BUDGET SUMMARY
(B/A IN $ MILLIONS)

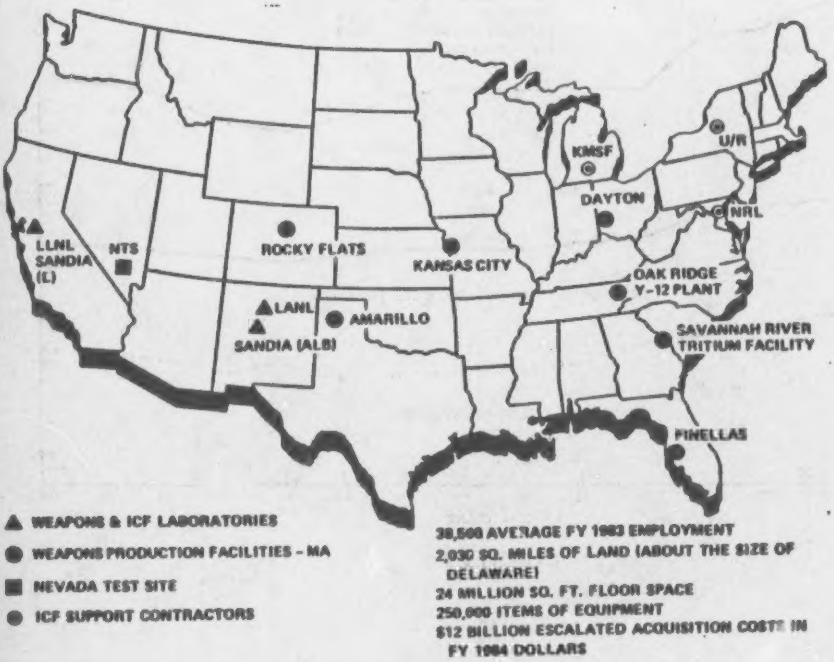
	FY 1983 APPROPRIATION	FY 1984 REQUEST
WEAPONS ACTIVITIES		
RESEARCH, DEVELOPMENT AND TESTING	$1,184.8	$1,380.1
INERTIAL FUSION	189.7	151.8
PRODUCTION AND SURVEILLANCE	1,900.9	2,337.3
PROGRAM DIRECTION	50.1	55.9
SUBTOTAL WEAPONS	$3,325.5	$3,925.1
NUCLEAR MATERIALS		
MATERIALS PRODUCTION	1,202.8	1,485.3
DEFENSE WASTE AND BYPRODUCTS MGMT	518.7	611.5
SUBTOTAL NUCLEAR MATERIALS	$1,721.5	$2,096.8
SECURITY AFFAIRS		
VERIFICATION AND CONTROL TECHNOLOGY	53.9	61.7
NUCLEAR SAFEGUARDS AND SECURITY	47.4	52.0
SECURITY INVESTIGATIONS	28.5	29.5
SUBTOTAL SECURITY AFFAIRS	$ 129.8	$ 143.2
TOTAL DEFENSE PROGRAMS	$5,176.8	$6,165.1
NAVAL REACTORS	526.9	613.0
TOTAL ATOMIC ENERGY DEFENSE ACTIVITIES	$5,703.7	$6,778.1

CHART 2

WEAPONS ACTIVITIES FY 1984 APPROPRIATIONS REQUEST (B/A IN $ MILLIONS)

	FY 1983	FY 1984
OPERATING EXPENSES		
RESEARCH, DEVELOPMENT AND TESTING	$1,049.8	$1,190.4
INERTIAL FUSION	140.0	127.1
PRODUCTION AND SURVEILLANCE	1,474.5	1,779.7
PROGRAM DIRECTION	50.1	55.9
TOTAL OPERATING EXPENSE	$2,714.4	$3,153.1
CAPITAL EQUIPMENT	196.0	234.6
CONSTRUCTION	415.1	537.4
TOTAL WEAPONS ACTIVITIES	$3,325.5	$3,925.1

CHART 3


LLNL
SANDIA (L)
NTS
ROCKY FLATS
LANL
SANDIA (ALB)
AMARILLO
KANSAS CITY
KMSF
DAYTON
U/R
NRL
OAK RIDGE Y-12 PLANT
SAVANNAH RIVER TRITIUM FACILITY
PINELLAS
▲ WEAPONS & ICF LABORATORIES
● WEAPONS PRODUCTION FACILITIES - MA
■ NEVADA TEST SITE
● ICF SUPPORT CONTRACTORS

38,500 AVERAGE FY 1983 EMPLOYMENT
2,030 SQ. MILES OF LAND (ABOUT THE SIZE OF DELAWARE)
24 MILLION SQ. FT. FLOOR SPACE
250,000 ITEMS OF EQUIPMENT
$12 BILLION ESCALATED ACQUISITION COSTS IN FY 1984 DOLLARS

CHART 4

WEAPONS ACTIVITIES
FY 1984 APPROPRIATIONS REQUEST
PRODUCTION AND SURVEILLANCE
(B/A $ MILLIONS)

	FY 1983	FY 1984
OPERATING EXPENSES		
WAR RESERVE NEW PRODUCTION	$ 912.1	$1,100.3
STOCKPILE MAINTENANCE	138.9	195.8
STOCKPILE EVALUATION	139.5	145.4
PROCESS DEVELOPMENT	79.6	96.6
OTHER COSTS	204.4	241.6
TOTAL OPERATING EXPENSES	$1,474.5	$1,779.7
CAPITAL EQUIPMENT	92.0	114.4
CONSTRUCTION	334.4	443.2
TOTAL PRODUCTION AND SURVEILLANCE	$1,900.9	$2,337.3

CHART 22

DEPARTMENT OF ENERGY WEAPONS PROGRAM

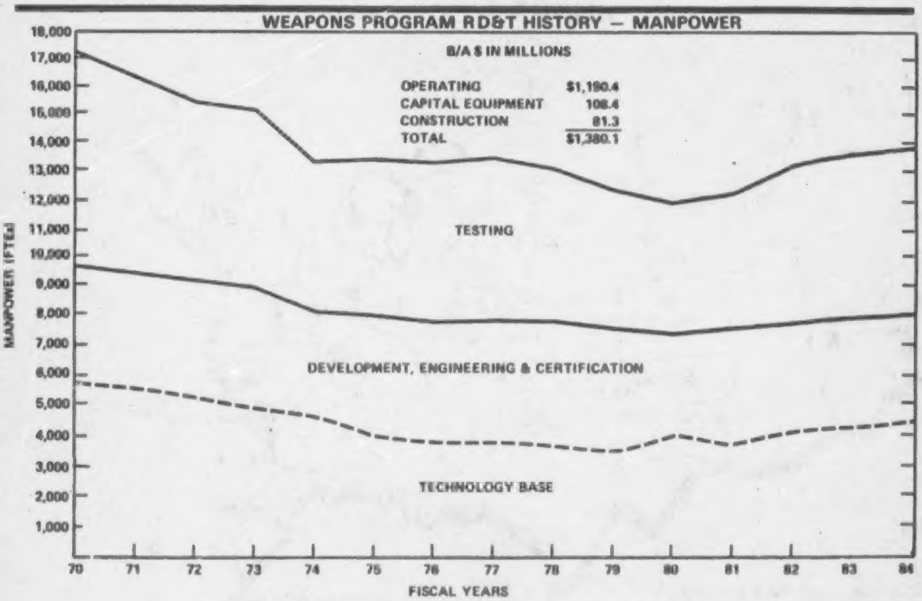


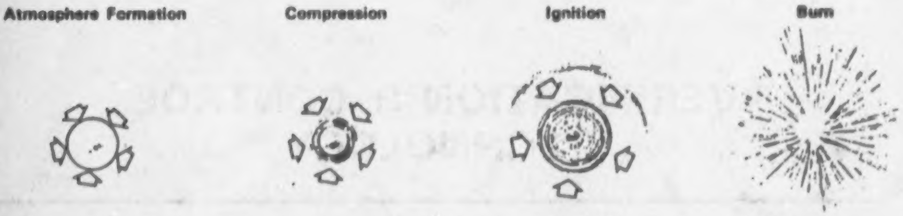
CHART 27

WEAPONS ACTIVITIES
FY 1984 APPROPRIATIONS REQUEST
RESEARCH, DEVELOPMENT AND TESTING
(B/A $ MILLIONS)

	FY 1983	FY 1984
OPERATING EXPENSES		
RESEARCH AND DEVELOPMENT	$ 641.5	$ 714.5
TESTING	408.3	475.9
TOTAL OPERATING EXPENSES	$1,049.8	$1,190.4
CAPITAL EQUIPMENT	93.0	108.4
CONSTRUCTION	42.0	81.3
TOTAL RESEARCH, DEVELOPMENT AND TESTING	$1,184.8	$1,380.1

CHART 36

INERTIAL FUSION CONCEPT



Laser or particle beams rapidly heat the surface of the fusion target forming a surrounding plasma envelope.

Fuel is compressed by rocket-like blowoff of the surface material.

With the final driver pulse, the full core reaches 1000 – 10,000 times liquid density and ignites at 100,000,000°C.

Thermonuclear burn spreads rapidly through the compressed fuel, yielding many times the driver input energy.

CHART 37

WEAPONS ACTIVITIES
FY 1984 APPROPRIATIONS REQUEST
INERTIAL FUSION
(B/A $ MILLIONS)

	FY 1983	FY 1984
OPERATING EXPENSES		
GLASS LASER EXPERIMENTS	$ 75.1	$ 70.4
GAS LASER EXPERIMENTS	41.8	38.2
PULSE POWER	20.0	18.5
SUPPORTING RESEARCH	3.1	0
TOTAL OPERATING EXPENSES	$140.0	$127.1
CAPITAL EQUIPMENT	11.0	11.8
CONSTRUCTION	38.8	12.9
TOTAL INERTIAL FUSION	$189.8	$151.8

CHART 38

VERIFICATION & CONTROL TECHNOLOGY

GOALS

- DEVELOP AND PRODUCE TECHNOLOGY TO MONITOR NUCLEAR WEAPON ACTIVITIES AND TO VERIFY NUCLEAR TEST TREATY COMPLIANCE
- CONTROL NUCLEAR AND ENERGY-RELATED EXPORTS AND TECHNOLOGY TRANSFER IN ACCORDANCE WITH NATIONAL SECURITY AND NONPROLIFERATION POLICY
- PROVIDE TECHNICAL AND ANALYTICAL SUPPORT FOR DOE'S ROLE IN NUCLEAR ARMS CONTROL NEGOTIATIONS
- MANAGE DOE'S INTELLIGENCE PROGRAM AND PROVIDE UNIQUE EXPERTISE TO THE INTELLIGENCE COMMUNITY

CHART 42

DEPARTMENT OF ENERGY
VERIFICATION AND CONTROL TECHNOLOGY PROGRAM
THE RSTN NETWORK

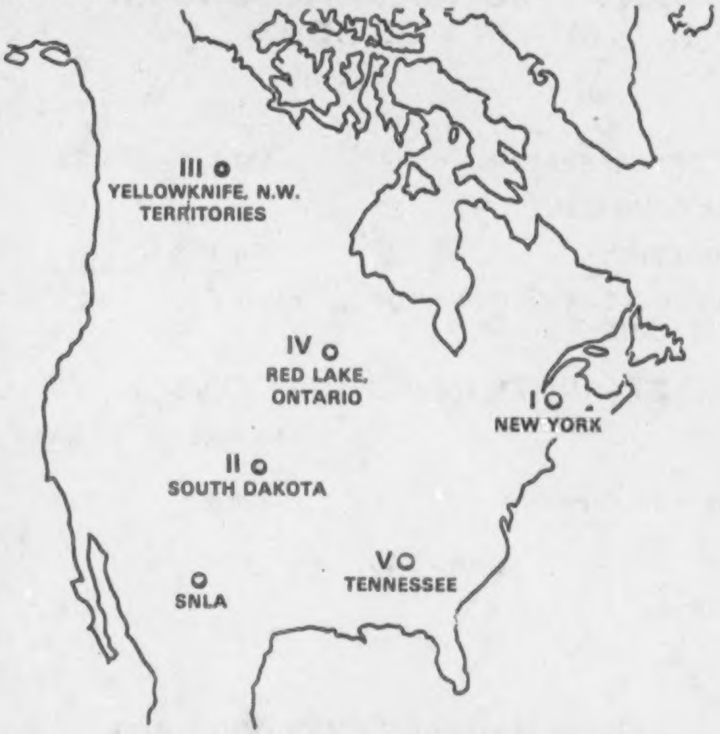

III
YELLOWKNIFE, N.W. TERRITORIES
IV
RED LAKE, ONTARIO
I
NEW YORK
II
SOUTH DAKOTA
V
TENNESSEE
SNLA

CHART 45

VERIFICATION AND CONTROL TECHNOLOGY FY 1984 APPROPRIATIONS REQUEST (B/A IN $ MILLIONS)

	FY 1983	FY 1984
OPERATING EXPENSES		
DETECTION TECHNOLOGY	$37.5	$41.6
ANALYTICAL SUPPORT	13.1	15.5
PROGRAM DIRECTION	1.8	2.8
TOTAL OPERATING EXPENSES	$52.4	$59.9
CAPITAL EQUIPMENT	1.5	1.8
TOTAL VERIFICATION AND CONTROL TECHNOLOGY	$53.9	$61.7

CHART 46

NUCLEAR SAFEGUARDS AND SECURITY FY 1984 APPROPRIATIONS REQUEST (B/A IN $ MILLIONS)

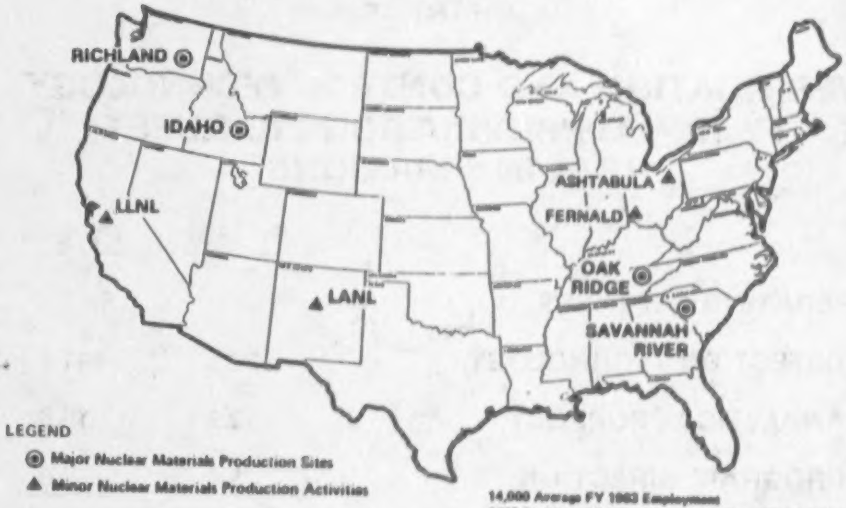
	FY 1983	FY 1984
OPERATING EXPENSES	$43.2	$48.0
CAPITAL EQUIPMENT	3.7	4.0
CONSTRUCTION	0.5	0
TOTAL NUCLEAR SAFEGUARDS AND SECURITY	$47.4	$52.0

SECURITY INVESTIGATIONS

	FY 1983	FY 1984
OPERATING EXPENSES	$28.5	$29.5

CHART 47

NUCLEAR MATERIALS PRODUCTION SITES


RICHLAND
IDAHO
LLNL
LANL
ASHTABULA
FERNALD
OAK RIDGE
SAVANNAH RIVER
LEGEND
Major Nuclear Materials Production Sites
Minor Nuclear Materials Production Activities

14,000 Average FY 1983 Employment
1853 Sq. Miles of Land—1½ Times the Size of Rhode Island
$13.4 Billion—Escalated Acquisition Costs in FY 1984 Dollars

CHART 49

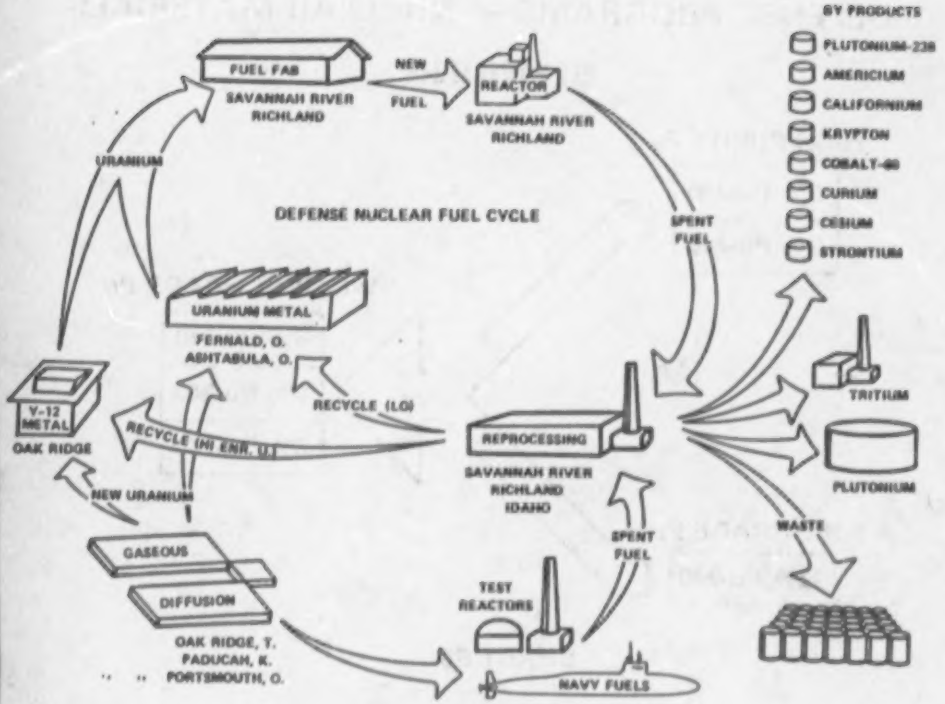

DEFENSE NUCLEAR FUEL CYCLE
FUEL FAB
SAVANNAH RIVER
RICHLAND
NEW
FUEL
REACTOR
SAVANNAH RIVER
RICHLAND
SPENT
FUEL
BY PRODUCTS
PLUTONIUM-238
AMERICIUM
CALIFORNIUM
KRYPTON
COBALT-60
CURIUM
CESIUM
STRONTIUM
URANIUM
URANIUM METAL
FERNALD, O.
ASHTABULA, O.
Y-12
METAL
OAK RIDGE
RECYCLE (LO)
RECYCLE (HI ENR. U)
REPROCESSING
SAVANNAH RIVER
RICHLAND
IDAHO
TRITIUM
PLUTONIUM
WASTE
NEW URANIUM
GASEOUS
DIFFUSION
OAK RIDGE, T.
PADUCAH, K.
PORTSMOUTH, O.
SPENT
FUEL
TEST
REACTORS
NAVY FUELS

CHART 53

NUCLEAR MATERIALS PRODUCTION
FY 1984 BUDGET REQUEST
BUDGET SUMMARY
(BA IN MILLIONS)

	FY 1983 APPROP.	FY 1984 REQUEST
BASE	$ 838.7	$1,042.9
PRODUCTION INITIATIVES		
RESTORATION	122.1	133.8
L REACTOR UPGRADE	60.5	73.5
PUREX FUEL PROCESSING REACTIVATION	67.1	82.9
HIGH PRODUCTIVITY CORES	18.7	68.3
SPECIAL ISOTOPE SEPARATION	76.0	51.9
NEW PRODUCTION REACTOR	2.0	5.0
REACTOR SAFETY	16.2	14.6
SECURITY PROJECTS	1.5	12.4
	$1,202.8	$1,485.3

CHART 58

DEFENSE PROGRAMS — NUCLEAR MATERIALS

BLENDING

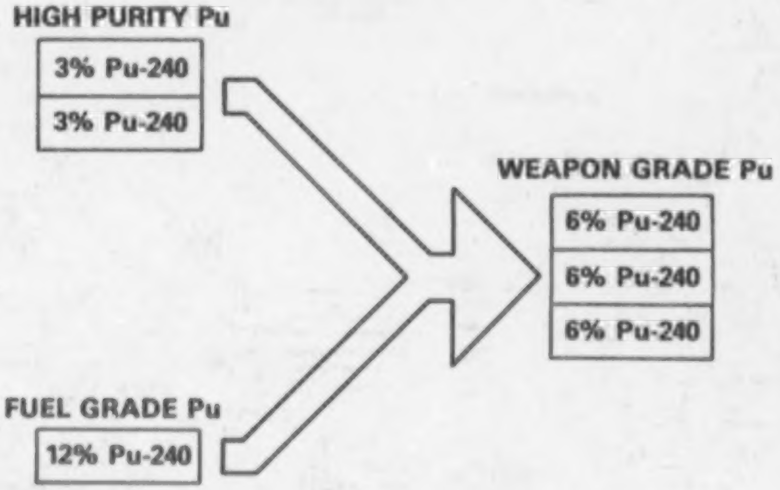

HIGH PURITY Pu
3% Pu-240
3% Pu-240
WEAPON GRADE Pu
6% Pu-240
6% Pu-240
6% Pu-240
FUEL GRADE Pu
12% Pu-240

CHART 59

DEFENSE NUCLEAR WASTE

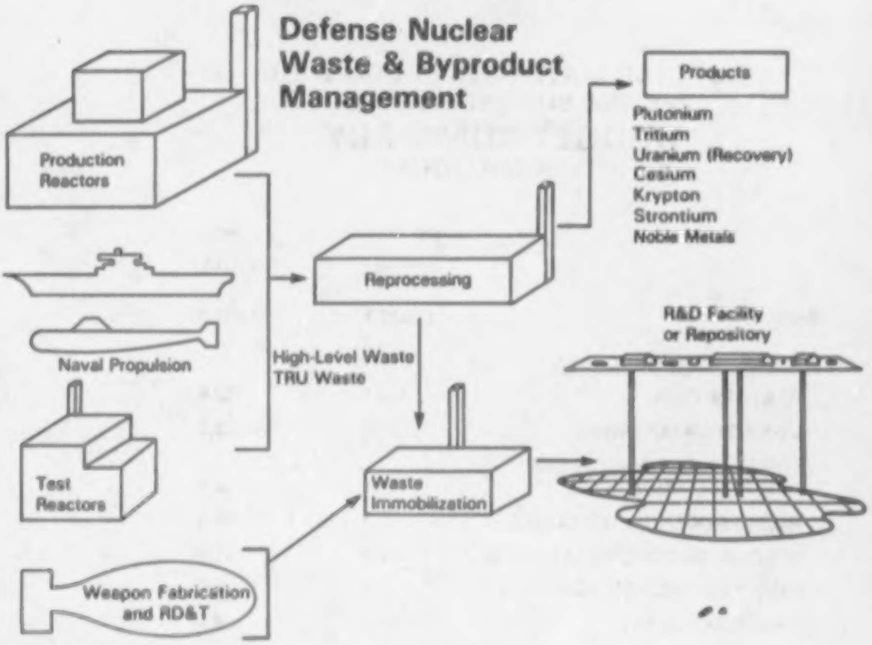

Defense Nuclear Waste & Byproduct Management
Production Reactors
Naval Propulsion
Test Reactors
Weapon Fabrication and RD&T
Reprocessing
Products
Plutonium
Tritium
Uranium (Recovery)
Cesium
Krypton
Strontium
Noble Metals
High-Level Waste
TRU Waste
Waste Immobilization
R&D Facility or Repository

CHART 60

DEFENSE WASTE AND BYPRODUCTS MANAGEMENT

Defense Waste Inventory

(As of 12/31/81)

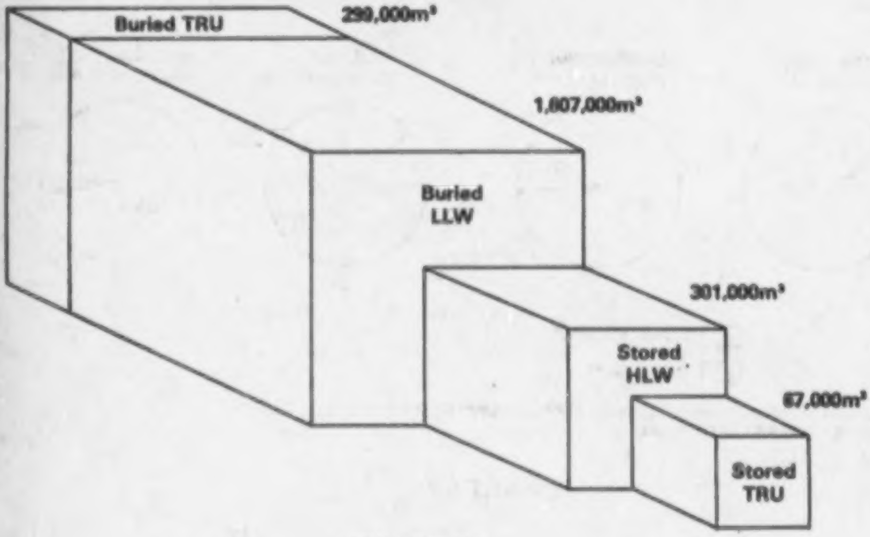


CHART 61

DOE DEFENSE HIGH-LEVEL WASTE INVENTORY STORED IN UNDERGROUND TANKS (12/31/81)

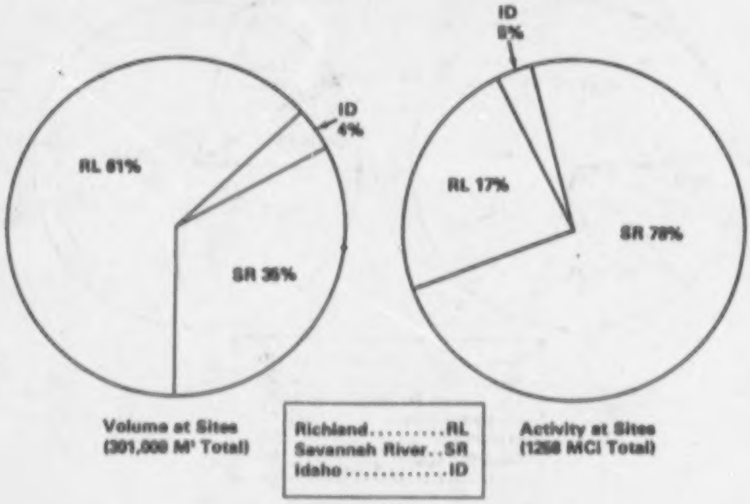
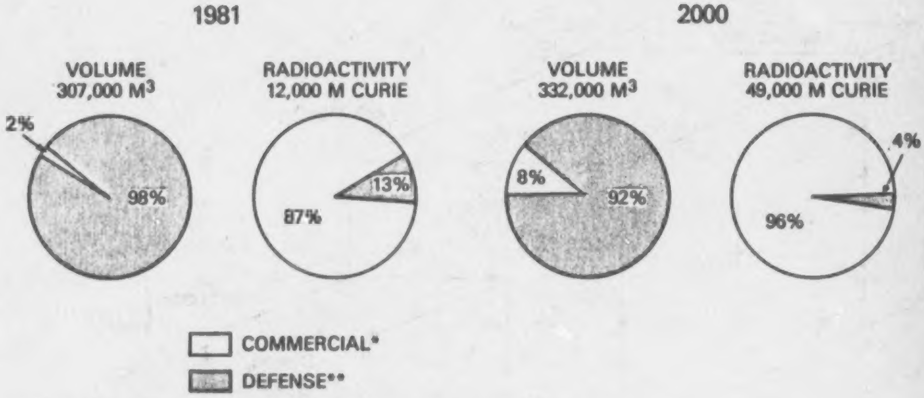


CHART 62

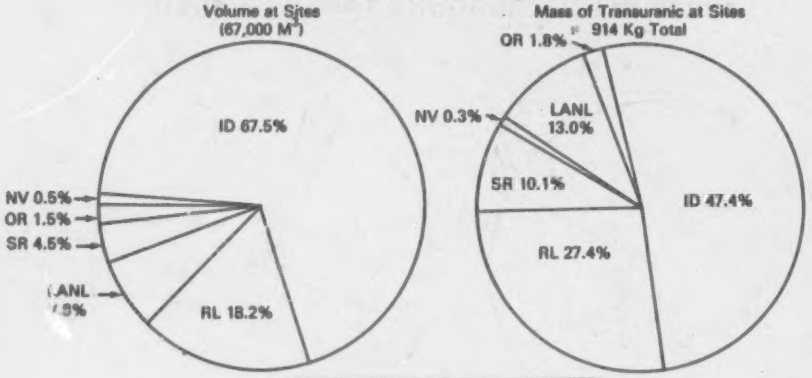
DEFENSE WASTE AND BYPRODUCTS MANAGEMENT
HIGH LEVEL WASTE INVENTORY (12/31/81)



* INCLUDES SPENT FUEL AND ASSUMES REPROCESSING STARTS IN 1989
** ASSUMES DWPF STARTS IN 1990

CHART 63

DEFENSE WASTE AND BYPRODUCTS MANAGEMENT
DOE DEFENSE TRANSURANIC STORED WASTE INVENTORY (12/31/81)



Idaho	ID
Richland	RL
Los Alamos National Lab.	LANL
Savannah River	SR
Oak Ridge	OR
Nevada	NV

CHART 64

DEFENSE WASTE AND BYPRODUCTS MANAGEMENT
FY 1984 BUDGET REQUEST
(BA in Millions)

	FY 1983 APPROP.	FY 1984 REQUEST
INTERIM WASTE OPERATIONS	$285.0	$317.0
LONG-TERM WASTE MANAGEMENT TECHNOLOGY (DEFENSE WASTE PROCESSING FACILITY)	106.3 (46.0)	211.3 (154.6)
TERMINAL STORAGE (WIPP)	125.4*	80.7
PROGRAM DIRECTION	2.0	2.5
TOTAL	$518.7	$611.5

* INCLUDES $50 MILLION PROPOSED FOR DEFERRAL UNTIL FY 1984.

CHART 65

STATEMENT OF RICHARD L. WAGNER, CHAIRMAN, MILITARY LIAISON COMMITTEE TO THE DEPARTMENT OF ENERGY, AND ASSISTANT TO THE SECRETARY OF DEFENSE (ATOMIC ENERGY) ON NUCLEAR WEAPONS PROGRAMS

Mr. Chairman and members of the committee, it is my pleasure to appear before you to discuss the Department of Defense's requirements and long-term objectives, as they relate to the Department of Energy's nuclear weapons program. I would like to highlight for you what I believe is the challenge facing the Departments of Defense and Energy and how, as I see it, we should face this challenge. I would then be pleased to answer your questions.

In the Nation's nuclear weapons program, the Department of Energy delivers two different kinds of products to the DOD; tangible, hardware products and intangible, idea products. Hardward products are all those things that support the current nuclear weapons stockpile, including not only weapons that already exist, but those whose production is approved or projected, as well. In the idea category are those things necessary for the continuing vitality of the advanced technology base which provides insurance against technological surprise as well as options to choose from for the farther future, and from which may result new, radically different nuclear weapons with which to strengthen deterrence, as well as less dramatic but still useful improvements. I want to say, up front, that these two different products are equally necessary, for reasons that I will develop later.

The DOE complex is now a year or two into a period of major challenge occasioned by the large projected weapon production workload to support DOD requirements approved by the President, and by the need to catch up in exploratory development, of which too little was done during the 1970's.

[Deleted.]

In December 1982 my Office published a document entitled, "The Nuclear Weapons Production and RD&T Complex—DOE Support of DOD Requirements" This document has been provided to the staff of this committee, and I urge that you review it in your consideration of the DOE program.

[Deleted.]

[Deleted.] Let me briefly discuss the production requirements and the research needs from the DOD point of view.

Let me first say a few words about the DOD's needs for the current stockpile—the area in which the DOE product is hardware—and how we develop requirements for it. An overview of the history and projections for the stockpile is shown in chart 1. Among other things, it shows systems in production now and systems in committed engineering development which will reach IOC during the next few years. Note that although we require increased production of nuclear weapons during the next few years, we are not just piling weapon on weapon. We are retiring many older weapons as new ones are produced. We are engaged in a modernization, not a major buildup, and the stockpile will remain below the peak levels of the mid-1960's.

The stockpile production plans are largely driven by three initiatives which, together, will assure that the United States continues to possess an adequate deterrent posture into the mid-1980's and beyond. These initiatives are:

[Deleted.]

—The strategic modernization program, which emphasizes improving the survivability of our strategic forces and enhancing our capability to retaliate in accordance with our national strategy against the full spectrum of Soviet targets.

—The longer range intermediate nuclear forces (LRINF) missile deployments, which will provide at least a partial counter to the Soviet missile threat to NATO.

—The long-overdue modernization of our other nonstrategic nuclear forces, which will improve the operational effectiveness, survivability, safety, security, and flexibility of this critical component of our overall deterrent posture.

These initiatives, which reflect the U.S. commitment to maintain a capability to deter Soviet aggression, will also help convince the Soviets to act in good faith with regard to negotiating arms reduction.

A detailed discussion of those warheads in production is contained in a report to the Congress on the justification of nuclear warhead build levels and a review and justification of the warhead retirement program submitted jointly by DOD and DOE in February to the Committees on Appropriations and the Committees on Armed Services of the Senate and the House of Representatives. This report is the most comprehensive exposition of the reasons for the production requests made by DOD of DOE that we have submitted to the Congress for several years. While it would be inappropriate to review it system by system here, I would like to make a few general comments about the stockpile requests, since it is sometimes alleged that these requests are inflated or otherwise unrealistic. I believe this is not the case.

The weapon stockpile requirement is derived by a process which starts from the most general and high-level national security policy objectives, then develops judgments about what defense postures are needed to deter the Soviets. It goes on to develop DOD force level requirements, taking into account realistic estimates of survival probabilities of our forces under attack, targeting, penetration of Soviet defenses, and logistics factors. There are many steps in this process that cannot be quantified, and are based on political and military judgment. They involve requirements based on formal operational plans (such as the single integrated operational plan and the strike plan of the Supreme Allied Commander, Europe), delivery systems availability, and our allies' requirements for nuclear support through programs of cooperation. So far what I have described is the process by which DOD plans its own nuclear system requirements.

Starting from DOD nuclear force level requirements, the translation of these considerations into stockpile plans per se (new production, retrofits, and retirements) is very much a joint DOD/DOE activity. Both the DOD and DOE are fully aware that, because of resource limitations, every effort must be made to make the most efficient use of DOE's unique capabilities. However, both Departments are also aware that in some cases, broader national security considerations dictate warhead production and retirement schedules. For example, warhead delivery schedules that appear to be inefficient when viewed solely from the DOE point of view, must be phased properly with the generally much more expensive DOD delivery systems; support for arms control initiatives or sensitive agreements with our allies may require accelerated development and deployment that can result in peaks and valleys in the DOE production workload. While both Departments work closely and continuously to minimize those adverse impacts, both feel that the Soviet and Warsaw Pact military buildup requires an urgency of response that justifies any remaining problem areas for DOE.

For the strategic and long-range INF systems, production quantities of nuclear warheads are nearly the same as the load capacity of delivery systems planned for deployment. In contrast to this, DOE production quantities for warheads for other nonstrategic nuclear forces cannot be derived in a simple way, solely from the number of available delivery systems, since many of the delivery systems are dual capable, both conventional and nuclear; for example, aircraft and artillery tubes. For these systems, the inventory requirements are driven much more by detailed operational and survivability requirements than by numbers of delivery systems. Determining these numbers is a matter of detailed analysis, leavened by military judgment that considers the growing capabilities of the pact forces. In this context, nuclear support of our allies is a significant factor in determining overall requirements and deployment and retirement actions.

Besides new production, the other factor that determines the stockpile is weapon retirement. As older weapons are retired, their nuclear material is used to build new warheads entering the stockpile. From the point of view of special nuclear material availability, it might be proposed that we could retire even more of the current weapons earlier than currently planned. However, other considerations enter which dictate retaining some older weapons.

Older systems, including those dual-capable systems that may no longer be as effective in the conventional mode, still constitute a major deterrent. If they were retired, they would have to be replaced by new weapons to retain the same level of deterrence.

In many cases, these weapons are the current centerpiece of formal programs of cooperation with allies. To further reduce their number without compensating modernization would diminish the valuable military capability and political commitment they represent for those nations—a commitment on the part of the United States to contribute to the defense of that nation, and a commitment by the nation to participate in NATO's common defense.

I have described the factors that go into the development of the weapon stockpile. While some of the considerations are not subject to rigorous quantitative derivation, I believe that they are thoroughly and responsibly worked out.

[Deleted.]

Now I would like to say a few words about our farther future needs. We have a rather firm idea of the hardware product we need and expect from DOE for the next decade or so. Beyond those projections, we have only a rather vague idea of the product that we will need from DOE, but we do know that we must manage stockpile acquisition not only to obtain the weapons we need today and in the near future, but also with an eye to the distant future because we don't want technological surprises. Therefore, we in DOD are also vitally interested in advanced development for nuclear weapons.

Accordingly, I want to make a strong endorsement for a very vigorous advanced concepts development program in DOE, for four reasons:

1. Advanced development in the past has paid off in today's weapons.
2. There will be a need for continuing improvements in the future, even with the kind of progress in arms control that we hope for, and certainly if that progress does not occur.
3. [Deleted] we need advanced development to avoid surprise.
4. Our capability in advanced technology, in and of itself, helps create a deterred point of view on the part of the Soviets. Let me take these points in turn.

What we really spend money on today in the weapon complex are new features and improved characteristics in warheads. Most of the RD&T effort goes for this, and the production effort would be substantially reduced if we built weapons today with the same features as those we were building 20 or even 10 years ago. So it's fair to ask whether we get our money's worth. I believe we do.

During the past 15 years or so, there have been a number of continuing and significant changes in the threat, in our understanding of our deterrence needs, and in other factors, including public perceptions, which have influenced our defense posture. Most of the R&D effort in the weapon complex has been devoted to improving weapon designs to meet requirements developing from these changes.

Starting in the late 1960's, we began to see that the Soviet view of deterrence was not the same as ours. They thought much more in terms of attacking military targets, thereby limiting damage to their own nation, and perhaps working toward a true first-strike capability. This is sometimes called a warfighting doctrine. We also came to realize that they value their military capability and their ability to maintain political control most highly. These views on their part were reflected in tangible ways. They began to harden, defend, disperse, and proliferate their military assets and their apparatus for political control.

Over a period of some years, we have been responding to these changes by reshaping our deterrent strategy to threaten what they value, rather than what we ourselves would value, and by developing an ability to attack the new target structure that reflects their values. These changes were reflected in new features for weapons systems and warheads themselves. For example, we needed higher yields to match harder targets, but still in small reentry vehicles because there are a great many military targets. We need bombs which could be delivered from very low altitudes to penetrate their massive and improved air defense, and hardened warheads [deleted].

Although it has now been dismantled, we did develop the Safeguard ballistic missile defense system. [Deleted.]

In theater nuclear weapons there has been a similar evolution. We deter the start of a war (either conventional or nuclear) by exhibiting the ability to halt and then destroy the Warsaw Pact's attacking forces. To make our nuclear response credible to both the pact leaders and our own allies, the weapons must be available for quick and flexible response, which means they must be forward deployed, and they must not produce so much undesired (collateral) damage that their use is incredible. To be able to maintain forward deployment, and to allow many of our weapons in wartime to be delivered by our NATO allies, it was necessary to develop special command and control features. The resulting permissive action links (PAL's) also provide some of the added security necessary in light of today's terrorist threat. We have continued to improve the PAL's [deleted].

In recent years there has been growing concern, on the part of segments of the public, for safety issues, sometimes almost amounting to a demand for a risk-free world. While some of us may think these demands are excessive, they are real, and must be taken into account when we consider the public views of the trust put in us in our stewardship of nuclear weapons. Our nuclear weapons have always been designed with a high level of safety built in, and the record over the last 38 years has been excellent. There has never been an accidental nuclear explosion of a U.S. nuclear weapon. However, in response to the heightened sensitivity, today's nuclear weapons are built to even more stringent safety standards than was the case even a few years back. Let me give you a few examples in this area in which the DOE has achieved significant progress. The electrical systems and strong link/weak link pairs in our modern warheads provide nuclear detonation fail-safe protection beyond that thought achievable in the 1960's. This accomplishment was the direct product of a vigorous effort to develop system concepts and components which would respond in a predictably safe manner even in severe accident environments (fire, crash, et cetera). The possibility of radioactive material dispersal in potential accidents involving nuclear weapons has been greatly decreased by use of insensitive high explosive (IHE) rather than the conventional explosives used in older weapons. Developing an IHE suitable for use in nuclear weapons required over 10 years of dedicated research and development.

[Deleted.]

So you can see that the advanced development done over the past 10 or 15 years has contributed substantially to making U.S. nuclear weapon designs much better suited to our political and military needs. This is shown graphically in chart 3, which outlines the improved warhead features developed in response to the changes I have just outlined in the broad political and military context, and chart 4, which shows how these features have been incorporated in the stockpile.

CHANGES SINCE LATE 1960'S

DETERRENCE REQUIREMENTS CHANGED	WARHEAD FEATURES IN RESPONSE
SOVIETS VALUE THEIR MILITARY CAPABILITY AND POLITICAL CONTROL	HIGHER YIELD TO SIZE/WEIGHT HIGHER YIELDS MIRV
SOVIETS IMPLEMENT "WARFIGHTING" POSTURE	LAYDOWN BOMBS
SOVIET TARTET BASE HARDER, DISPERSED SOVIET DEFENSES	WARHEAD HARDENING
FLEXIBLE RESPONSE	[DELETED]
REDUCED COLLATERAL DAMAGE	TAILORED OUTPUTS
RISE OF INTERNATIONAL TERRORISM	NONVIOLENT DISABLEMENT
INCREASED EMPHASIS ON RISK REDUCTION	IMPROVED USE CONTROL (PAL)
WEAPON SAFETY/SECURITY	INSENSITIVE HIGH EXPLOSIVE
	ENHANCED ELECTRICAL SAFETY
NEED TO REDUCE COST OF WEAPON SYSTEM ACQUISITION AND INCREASED READINESS	MAINTAINABILITY LONGER COMPONENT LIFE

CHART 3

[Chart deleted.]

Of course, it is true that not all the ideas worked on have ended up as improved features for stockpile weapons. Some lines of research have not yet led to applications, and may never, but this is to be expected in R&D. In some cases, there are those who argue that some new features were not needed. There are also those who argue that more new features should have been put in certain weapons. I would not argue that the developments have always been just right. But, on the whole, the R&D has been very responsive to the need.

Turning now to the future, we might ask: Will continued development on advanced concepts lead to useful improvements in weapon features in the future, and will such improvements be needed? I believe so, on both counts. Even if our best efforts at arms control succeed, we will need new nuclear weapon designs in the 1990's and beyond. If numbers of weapons are reduced, as we hope they will be, we will still need to insure that the most fundamental requirements of nuclear deterrence—survivability of our own weapons, crisis stability, ability to penetrate and destroy targets—are maintained. And as other technologies change, such as accuracy, command and control, sensors, antisubmarine warfare, et cetera, we will need to meet these fundamental requirements in new ways. We will almost certainly need new systems with new characteristics and these systems will need new warheads. If we are to be able to meet the defense needs of the 1990's and beyond, it is necessary for DOE to have an active, vigorous advanced development program now because there is a long lead time—10 years or more—between the concept and the hardware. Some areas in which I believe new developments will be most fruitful are the following:

Expecially for theater weapons, safety and security determine how we base and house weapons, which, in turn, determines how subject they are to disarming attack, either conventional or nuclear, by the Warsaw Pact. Improvements in safety and security features in weapons could lead to deployment approaches which greatly improve survivability, and the Soviet perception of the survivability of our nuclear weapons is a key factor in the stability of deterrence. In a broader sense, we must never stop safety and security improvements. If we do, the people on whom safety and security depend will become complacent or incompetent, an intolerable situation.

Another area of clear importance, where there is both significant opportunity and likely to be growing need, is for weapons in which the yield—the total energy produced by the explosion—is converted in some way to a form more precisely tailored to the need than just blast and heat. Such weapons might be used in much more discriminating ways than existing nuclear weapons—to apply enormous energy more directly onto the intended military target, to reduce the undesired damage to very low levels, to single out some particular type of damage—[deleted].

[Deleted.]

Such weapons might have their most important applications for defensive purposes [deleted]. Taking a long view, defensive systems may become much more important in the future. During the last decade of Soviet buildup of possible first-strike forces, and now that we are no longer superior, we have learned how important the survivability of our retaliatory forces is, [deleted].

[Deleted.]

My final reason for accelerating DOE advanced technology relates to what I called earlier, keeping the Soviets in a deterred frame of mind. Deterring the Soviets has often been thought of simply as a matter of keeping the Soviet attack exchange calculations unfavorable to them, both in our view and in theirs, thereby avoiding a Soviet attack. However, we are beginning to know more about how Soviet leadership views the arms competition in which we are engaged, and we can now see more clearly that much more is involved in deterring them than the arithmetic of exchange calculations—which is, of course, what you would expect. What it comes down to in the end is to keep their image of themselves inferior to their image of us, so that if a crisis comes they will have a gut feeling that they won't measure up against us. It is often said that the Soviet leaders are conservative. They are when they feel inferior, but they often are not when they don't feel inferior: they often have taken advantage when they perceive an opportunity, such as in Cuba or Afghanistan. Our job is to keep them feeling inferior, and thus conservative.

The Soviets have always been concerned with image—their obsession with propaganda and legitimacy shows that. Their images of themselves and of us, in the context of deterrence, are made up of many things—numbers and sizes of weapon systems, their technical characteristics, general technological capabilities of the two societies, national will and purpose, and place in the flow of history. Because of their buildup they have passed us in the more quantifiable elements of the image comparison—numbers and sizes of weapons. [Deleted].

[Deleted.] But, on the other hand, we know that tests between our technologies, such as U.S.-made jets versus Soviet-made jets over the Beka, a valley in Lebanon, and the technology of our cruise missile developments, are often sobering experiences for them. I believe that our level of technology in itself, quite apart from exactly how it is built in to fielded systems, affects their overall image of themselves and of us, and thus can have a significant deterrent effect.

The U.S.S.R. is pushing advanced technology hard, both in their own program and in getting it from us. They are active in improving the accuracy of their missiles, in [deleted] technology, in precision guidance, in cruise missile technology. We must not allow them to come to feel that the technological part of the balance has shifted in their favor, too. By the 1990's, we'll need some really new technology to keep the image ratio in our favor. The technology of nuclear explosive design is an important part of our overall technological capability.

[See chart 2 on p. 1142.]

In summary, the challenge we face is to balance the production of specific nuclear warheads needed to maintain deterrence today, with the need to revitalize the technology base from which will develop the concepts that will become the hardware of the 1990's and beyond. The Department of Defense is grateful to this committee for the support that you have given to this challenge in prior years. We need and count on your continued support for this vital program this year also.

I would now be happy to attempt to answer any of your questions. Thank you.

SUMMARY OF STATEMENT

Mr. ROSER. Very good. Thank you, Mr. Chairman. I will try to keep it brief. You do have a full written statement for the record. I would just like to talk from a few viewgraphs.

Sam, would you put the first chart up, please.

[Chart deleted.]

As you indicated, Mr. Chairman, we are concerned with the activities in the defense programs area of the Department of Energy, which include weapons activities, the production of nuclear materials, security affairs, and, of course, naval reactors, and Admiral McKee will cover that. I will not go into the details on the amounts. The total budget, exclusive of naval reactors, is $6.1-plus billion. I would like to cover a few program activities.

[Chart deleted.]

WEAPONS PRODUCTION

This is the famous mountain chart which we show you almost every year. That is our weapons production workload. As you can see, we are on a very steep curve. We are about halfwayup the knee of that curve.

I am pleased to report to you our weapons production is going very well, but we have a good deal of work to do in front of us over the next several fiscal years. Our production will peak in about 4 fiscal years.

Senator JOHNSTON. [Deleted.]

Mr. ROSER. The next chart is perhaps a better indication of our workload.

[Chart deleted.]

It depicts the workload interms of equivalent units. Although it is a little bit difficult to do this, it does provide a better way to assess and measure the overall workload than just looking at the workload in terms of the numbers of weapons required. We were manufacturing a lot more in terms of numbers of weapons back in the early seventies. The complexity of the weapons that we are manufacturing at the present time is much greater than it was in the early years.

[Chart deleted.]

PRODUCTIVITY IMPROVEMENTS

The next chart shows some of the production improvements that we have introduced in the area of robotics. This is a robot handling a part for a neutron generator in one of our factories where that piece can be cleaned and prepared for final assembly without the use of human hands. We are trying to introduce this type of equipment into the production complex to improve productivity wherever we can.

[Chart deleted.]

The next chart concerns our modernization and improvement program in the production complex. This shows an old lathe in one of our plants which was doing its job reasonably well, but it is about 30 years old.

[Chart deleted.]

We replaced that in our improvement program with the piece of equipment shown on the next slide. It has increased our productivity for this particular production activity by 30 percent. We think this has been an exceedingly good investment. This committee has supported that upgrading and modernization program in the production complex and we are beginning to see the results both in the equipment and in the productivity.

[Chart deleted.]

RESEARCH, DEVELOPMENT, AND TESTING

The next chart has to do with our testing program. We are gradually building up to what we believe represents a balanced program for testing [deleted.] We have been substantially below that over most of the last decade. As you can see, we are inching up. We are moving in a measured fashion, but we do want to get our test program up to the point where we feel that it is an adequate complement to our other research and development activities.

The blue part of the chart is development, engineering, and certification tests of weapons going into the stockpile at the present time. The red part shows those tests directed toward various new concepts or improved physics understanding. This is our technology base.

We try to keep a balance between those two areas. As you can see, in the last decade the red part of the chart almost disappeared, which meant that we were not doing very much in terms of looking at advanced concepts or looking at basic understanding of our nuclear weapons. We were devoting all of our effort to the development, engineering, and certification of new weapons systems.

Senator JOHNSTON. Is that mainly inertial confinement fusion?

Mr. ROSER. No, sir, I will get into that. These are actually field tests in Nevada. But they are, of course, an extension of our research and development program. The two peaks that you see there were driven pretty much by possible test ban treaties. These tests are a vital part of our research and development program. [Deleted].

We are doing much better in terms of the amount of data that we retrieve from each of the tests. They are expensive. We are striving to optimize, maximize the amount of data that we get from each one of the tests.

[See chart 27 on p. 1144.]

This again shows the relationship between the research, development, and testing components of the R&D activities. As you can see, testing is a part of the overall research, development, and testing component. The technology base efforts are shown by the dotted line on the bottom. We are going back toward a manpower level of about 16,000 in research, development, and testing. That will be below the peak which we had back in the early seventies, but is what we believe to be the optimal number to proceed with a balanced program in the future.

INERTIAL CONFINEMENT FUSION

I will talk a little bit about inertial confinement fusion.

[See chart 37 on p. 1145.]

This is obviously just a cartoon picture that indicates the purpose of the inertial confinement fusion program to try to bring energy from either a laser or particle beam accelerator onto a small deuterium-tritium target and to implode that target and, in essence, produce thermonuclear burn.

The current efforts that are being pursued in the weapons program are principally toward the weapons physics application of inertial confinement fusion. [Deleted].

In the laboratory, by using lasers and particle beams, we can implode a small deuterium-tritium target and, hopefully, we will sometime reach breakeven and perhaps even energy gain where we will get more from the explosion.

Senator JOHNSTON. What is the practical use in the weapons program?

Mr. ROSER. I want to get to that, Senator.

[Chart deleted.]

The next viewgraph shows one of the early inertial confinement fusion devices. That is the Helios laser at Los Alamos. It would never get to energy breakeven, but it does provide an energy source.

[Deleted.]

[Chart deleted.]

The next viewgraph is the Novette laser. It is the first two beams of the Nova laser which has been approved and is under construction as a 10-beam laser. In this configuration the two beams are being used to study some of the basic principles of the X-ray laser in the laboratory.

DIRECTED ENERGY WEAPONS

[Deleted.]

[Deleted.] This is one of the things we will be pursuing. But this device, which was built for the inertial confinement fusion program, is being used for weapons physics studies.

Senator JOHNSTON. That is fairly new use of that laser X-ray.

Mr. ROSER. It is.

Senator JOHNSTON. I know that is recent technology.

Mr. ROSER. [Deleted.]

Senator JOHNSTON. Now, to have the inertial confinement hooked up to your laser, how does that help on the laser X-rays?

Mr. ROSER. This device, when it is used to heat certain materials, is expected to produce X-rays.

Senator JOHNSTON. Then you put your X-ray back through the system?

Mr. ROSER. At a laboratory scale, we try to study how those come out of that particular experiment and how they can be——

Senator JOHNSTON. The reason I am asking is, I have been hearing all of these years about the defense importance of inertial confinement fusion and have taken that with a grain of salt. This is a brand new justification.

Mr. ROSER. That is right. That is the reason I wanted to mention it.

Senator JOHNSTON. I didn't know what the previous justification was. Well, that is sacred, but it is very useful.

Mr. ROSER. No, really, Mr. Chairman, what that inertial confinement fusion tool does, and we have three principal ones—I will show you the other two in just a moment—it, in essence, brings into the laboratory what happens in an underground thermonuclear explosion under the test site in Nevada at a scale that you can handle in the laboratory.

Now, we have not reached the point where we can really get thermonuclear burn from those pellets. We get some burn, but we don't get enough to say we are getting more energy out of the pellet than it takes to implode it. But we are getting some very useful information which we can use in studying such things as X-ray lasers, [deleted]. What it does, in essence, is give us a laboratory tool that we can study in micro terms what happens when we shoot an underground shot.

Senator JOHNSTON. In your judgment, are they sufficient to support your involvement in this program?

Mr. ROSER. Very much so.

Senator JOHNSTON. Aside from the fact whether you ever get energy breakeven.

Mr. ROSER. That is right. If we get energy breakeven with these, it will be a plus. But a couple of years ago, when I cam to the program, it lacked focus. We decided that we really needed to direct it toward weapons physics because it was being funded by the weapons program. So we are, indeed, now using it for weapons physics. If it ever does, indeed, produce breakeven in energy, that will simply be a plus, because we are using it for weapons physics studies and weapons physics experiments at the three laboratories.

Senator JOHNSTON. Thank you.

[Chart deleted.]

Mr. ROSER. The next one is the Antares laser at Los Alamos, which is almost complete. That is a carbon dioxide laser. [Deleted.] We are making good progress with that.

[Deleted.]

[Deleted.] So, it becomes a matter of judgment.

MX-RELATED ISSUES

Actually, there are a number of ways in which the Soviets might attack dense pack, and these fratricide issues are pertinent to, perhaps, only one or two of them. It is a big, complicated subject. I would be happy to go through it at some length if you would like.

Senator JOHNSTON. Obviously that is the question of the day, because we have the MX in here. If I am out of order on MX, if you would like to give something else first and we will come back to that.

Mr. ROSER. No, Mr. Chairman.

Senator JOHNSTON. What other mechanism, other than fratricide, which is neutrons and EMP, do we rely on for the dense pack?

Dr. WAGNER. The principal mechanism probably will be dust and debris fratricide. The nuclear explosion close to the surface of the Earth raises giant clouds.

Senator JOHNSTON. I understand that. That would be, in your judgment, the primary mechanism, because we couldn't have enough confidence in EMP or neutrons.

Dr. WAGNER. I think that the Soviets would have to add [deleted] in order to allow them to survive down through the dust cloud and the debris. It is not just dust. It is particles in some cases this big.

Senator JOHNSTON. It would slow them down, too, wouldn't it?

Dr. WAGNER. I think it would destroy the RV as it came in.

Senator JOHNSTON. Couldn't they figure out how to slow it down?

Dr. WAGNER. If they slow the RV down, its accuracy is ruined and they wouldn't be able to kill the silo they are aiming at. So let me say, though, that I think the issue about all of the fratricide effects is that without being able to do nuclear tests in the atmosphere, which they can't do and we can't do because of the limited test ban treaty, we are fairly sure that the data base on atmospheric bursts that we have and they have is not adequate for them to understand how to evade these fratricide mechanisms. There just was not enough scientific data generated back during the fifties and early sixties to give them confidence in being able to evade these various mechanisms.

Senator JOHNSTON. One more question on that. To avoid the dust cloud, if you have—first of all, ground penetration would solve it.

Dr. WAGNER. Would help, that is right.

Senator JOHNSTON. It would solve it.

Dr. WAGNER. Well, it might not solve it completely. The Earth penetrator would, of course, also raise the dust cloud which might last for some length of time so a second wave could be——

Senator JOHNSTON. For the second wave, but not for those already in the ground, obviously.

Dr. WAGNER. But we felt, also, there is a way of beating the Earth penetrator, which was to surround the silos with boulder fields. Now there is some argument as to the cost of creating boulder fields around the silos. The Corps of Engineers has done cost estimates. The cost is, perhaps, a billion dollars, but it may be uncertain by a factor of two—maybe half a billion, a couple billion. It is not a negligible sum, but a small fraction of the MX cost.

The boulders would be such that an Earth penetrator would be deflected by the surface of the boulder. The Earth penetrator has to pretty much come straight on to be able to penetrate.

Senator JOHNSTON. Let me ask, the briefing I had on MX seemed to indicate at that time—they were talking about the dust cloud. They also talked about the difficulty of getting the simultaneous blast because it had to be so simultaneous that the window of time was minimal seconds long.

Dr. WAGNER. [Deleted.]

Senator JOHNSTON. But if what you are saying is correct, and that is what I have been told by others, and that is you can harden against the EMP and the neutrons, then the simultaneity need not be so precise. It needs to be simply precise enough to defend against the dust cloud, which apparently they could all be coming down approximately together.

Dr. WAGNER. [Deleted.]

Let me say that all of this, you know, this whole offense-defense game, consists of moves on the part of the offense, moves on the part of the defense, countermoves on the part of the offense. Any offense tactic can probably be beaten by the defense. Any defense tactic can probably be beaten by the offense. The question is, how long is the interval between those movements?

The argument for MX is that it would take some length of time, several years, for the Soviets to do the things they would have to do to get confidence, and they require confidence. They are betting their country on their ability to beat our silos. It would take some years for them to do the test programs that they would need to gain the confidence.

DOD has not advanced MX as the final solution for ICBM vulnerability. [Deleted.] But there is always a countermove that will beat it, and perhaps a counter-countermove.

MX BASING MODE

Senator JOHNSTON. I take it you would deploy MX in another mode other than dense pack.

Dr. WAGNER. I finally came down, personally, believing that dense pack was worth doing, that it would buy enough years, and that the problem was severe enough that it was worth the money. But it is by no means the final solution.

I would argue that at the very same time we start on dense pack, or perhaps the President's Commission will recommend some other mode of deployment for MX, that we should, at the same time, start on something which would be a more certain long-term survival mode for the ICBM's. I, personally, tend to favor a thing that DOE has not talked much about yet, which is a small single-warhead, mobile, hardened to some extent.

Senator JOHNSTON. Would you favor that over a dense pack?

Dr. WAGNER. I think it will take too many years to get to confidence in that kind of system, so I think we ought to fill in the gap with dense pack.

Senator JOHNSTON. When you say "the gap"—I mean in the meantime we have [deleted] submarine-launched ballistic missiles.

Dr. WAGNER. Warheads.

Senator JOHNSTON. I mean warheads. The figure they usually give is [deleted] can get through. Isn't that enough?

Dr. WAGNER. I will address the question of how much is enough when I speak. The point you are really raising is, do we need all three of the triad legs.

Senator JOHNSTON. During the time that the MX will be deployed.

Dr. WAGNER. During that interval. My feeling is that we ought not to give up that third triad leg during that interval.

Senator JOHNSTON. No. We still have Minuteman.

Dr. WAGNER. Minuteman during that interval—I mean the window of vulnerability I think really will be a fact. I think Minuteman will be quite vulnerable during that 1987 through 1993, 1994 period.

Senator JOHNSTON. But not the submarine.

Dr. WAGNER. The submarine, of course, is considered less vulnerable. However, one of the things [deleted] and Admiral McKee might be able to amplify on this to some extent, [deleted] is when the Soviets will be able to make substantial improvements in their ASW.

Senator JOHNSTON. The CNO and Secretary of the Navy said the oceans are getting less visible, more opaque as he put it, not less, and that they are opaque now and getting more so. That is the trend on both sides, both for them and us.

Dr. WAGNER. I think another problem with relying on only the two legs of the triad—the bombers and the submarines—is that the command and control for both of the systems may be more vulnerable than we would like it to be. However, I believe that the capability of the Soviets to put together a first strike against all three legs of the triad, even during this window of vulnerability, is not large. It is rather unlikely that they could.

Senator JOHNSTON. It is nonexistent, really, when you talk about the submarines, is it?

Dr. WAGNER. It is not clear to me it is nonexistent. I don't think anyone can guarantee anything. The stakes are so high it seems to me we ought not to back off from that third leg of the triad. It is unlikely they could do it, but I don't think we could say it is impossible. So we ought to have that third leg for insurance. That is my feeling.

Senator JOHNSTON. I have interrupted you, Mr. Roser. Please proceed.

Mr. ROSER. That is quite all right, Mr. Chairman. This is important. We want to give you the information that is useful to you.

Senator JOHNSTON. I want to come back to this subject, because these are really the questions of the day.

Mr. ROSER. Dr. Wagner, in his testimony, will hit on that, how much is enough, because that is a frequently asked question and one that we want to be sure we give you the best information which we can that will give you the feeling that you can understand how much is enough. It is a judgmental thing.

PROTON BEAM FUSION EXPERIMENTS

I would like to go through a few more things here. This is the last of the inertial confinement fusion devices that we are operating. This is a proton beam fusion accelerator being built at Sandia. It is a different approach. It is a particle beam accelerator that uses a little larger target than the laser target.

We are making very good progress on being able to focus that particle beam and bring to bear on the target adequate amounts of energy. We get sufficient output from those imploding capsules to do some very good weapons physics.

Senator JOHNSTON. What is your own personal judgment as to whether we will be able to say how long it will take to get a particle beam sufficiently able to disarm something else at a great distance?

Mr. ROSER. That, of course, is another question, another problem we are working on. That is, the DARPA people are working on that. I think some of the work that will be done on this machine, in terms of our capability to focus that energy on a target chamber, will be applicable to the focusing of the beam that will propagate through the atmosphere.

Senator JOHNSTON. You mean through space.

Mr. ROSER. Well, through space it is relatively straight-forward now. We believe that we can focus it exoatmospherically. It is through the atmosphere that the problem comes, where the beam tends to not be able to——

Senator JOHNSTON. It dissipates in the atmosphere.

Mr. ROSER. It dissipates, but also tends to wriggle. You can't keep it directed.

Dr. WAGNER. You know, a lightning bolt doesn't really dissipate. It wriggles, but it strikes through a path and then the return path and subsequent strikes go through the same path. The particle beam weapon for atmospheric use depends on the same mechanism. The first part of the beam clears a path, in effect. Then the following beam follows through that channel.

Senator JOHNSTON. That happens with lightning?

Dr. WAGNER. Yes. The phenomena are pretty similar.

Again, you are asking interesting questions. Much of the DOD program is done at the DOE labs, but it is a DOD-funded program, and there are several levels of success. A large system that might be used for nationwide ballistic defense from electronic beam generators, [deleted].

[Deleted.]

Senator JOHNSTON. [Deleted.]

Mr. ROSER. [Deleted.]

Dr. WAGNER. Yes.

Mr. ROSER. Some of the word that is being done on this accelerator in focusing may well be applicable to that.

Senator JOHNSTON. This has been very helpful, because I was skeptical about the real weapons value of inertial confinement fusion.

Mr. ROSER. We were, too, very candidly, Mr. Chairman. But over the last 2 years we have really redirected the program where its focus is on weapons. It is producing good weapons physics.

[Chart deleted.]

This chart indicates what the stockpile will look like and has looked like or does look like at the present time. This simply indicates that the volume of new builds in the current period of the stockpile memorandum from 1983 through 1996 principally are replacements to existing weapons. The lower part of the chart shows the currently stockpiled weapons and how those decline, and the middle part of the chart are the new builds which really are replacements.

[Chart deleted.]

As you can see, the level of the stockpile does go up [deleted] between now and the end of the nineties, but it is a very modest increase. The bulk of our build is for replacement work for the stockpile.

NUCLEAR MATERIALS PRODUCTION

[Deleted.]

Senator JOHNSTON. You will need a new reactor for that, won't you?

Mr. ROSER. Yes, sir, the initial funding for the new reactor is in the 1984 budget. There is $5 million in operating funds.

HTGR BREEDER CONCEPT

Senator JOHNSTON. It has been suggested that perhaps we ought to go to the HTGR as a breeder. What is your judgment on that?

Mr. ROSER. We convened a high-level panel and we have their recommendations which we are studying. We asked them to look at several reactor concepts, one of which was the HTGR, and at several locations: Savannah River, Richland, Idaho, and Nevada. We eliminated Nevada.

That is under study in the Department of Energy. I am prepared, hopefully very shortly, in the next month or so, to make a recommendation to the Secretary of Energy on a technology and the site.

Senator JOHNSTON. I think it certainly has the advantage that as there is this public perception about the light water reactors being too dangerous—the figures about accidents belie that public perception, but in this business perception is reality—HTGR is certainly, at least hopefully, much safer.

Mr. ROSER. The graphite moderated reactor has the advantage of more inherent safety because of a large heat sink. This certain is being considered in the technical recommendations.

Senator JOHNSTON. We may get the spinoff from it if you could use it to develop that.

Mr. ROSER. There could be commercial spinoff in later years. But it is one of the technologies which we are looking at.

Senator JOHNSTON. What are the principal disadvantages of using the HTGR for weapons materials production?

Mr. ROSER. There aren't really any. This is a good tritium producer, reasonably good. It is a good plutonium producer. Of course, in asking this group to look at this, we looked at the coproduction, or the use of the waste heat, that a production reactor would produce for production of steam for some byproduct use. The HTGR is very good in this regard, I think.

Some of the other reactor concepts are also useful in this regard. The N Reactor, which is also a graphite-moderated reactor, would have some of the same features. But we are looking at all of them and hope to make a sound technical judgment and recommendation to the Secretary of Energy on the basis of that technical judgment within the next couple of months, Mr. Chairman.

Senator JOHNSTON. As I say, I want to put in the pitch for the HTGR, because I would personally very much like to see—and I think we are going to come in this country to a reawakening to nuclear energy as being maybe not the answer, but a very important part of the mix which has been neglected lately. But if we get on with these coal problems, of which there are already some, or we are beginning to see with acid rain and we will see it even more as pollution arises, I would like an alternative.

Mr. ROSER. I agree, Mr. Chairman. I think we dare not, in the long run, reject the nuclear alternative because it is not the ultimate answer necessarily, but it certainly is a part of the answer, in my opinion.

Senator JOHNSTON. Thank you. Sorry to interrupt you so much.

Mr. ROSER. Not at all, sir.

[Chart deleted.]

PRODUCTION REACTORS

This is just an indication of the production reactors we have on line at the current time. We currently have four. When we restart the L Reactor at Savannah River, which we hope we will be able to do in October of this year, we will have five. The fourth is located at Savannah River and the fifth N Reactor is located at Richland.

[Chart deleted.]

This shows the mix of those five. As it indicates, out through the next decade [deleted] will be devoted to the production of tritium and the balance to plutonium. [Deleted.]

[Chart deleted.]

This chart indicates the plutonium equivalent requirement which [deleted].

[Deleted.] This is both plutonium and tritium that is in the stockpile. This indicates how we will get there: principally the Savannah River reactors; but also the initiatives of blending the operation of the N reactor; the use of the Mark 15 charge in the Savannah River reactors; special isotope separation, which we are continuing the development and prototype funding on; and shown in the very top slice at the top of the chart the new production reactor coming on line in the mid-nineties.

DEFENSE WASTE AND BYPRODUCTS MANAGEMENT

The other aspect of our nuclear materials production is handling the waste and byproducts.

[See chart 61 on p. 1151.]

This indicates the current inventory of defense waste, showing buried transuranic waste, buried low-level waste, or low-level waste and stored transuranic waste.

As you recall, Mr. Chairman, we are due to have to the Congress by June 30 this year a defense waste management plan. The staff of this committee, as well as our other authorizing committees, have been briefed on the draft of this plan. I am happy to say that the reaction to it has been good. I believe we have reached resolution on a question raised concerning the buried transuranic waste.

Senator JOHNSTON. That is low-level transuranic waste.

Mr. ROSER. The low level is the buried waste, the large block there, of 1,607,000 cubic meters. That is adequately taken care of. The buried transuranic waste of the Idaho site was buried before we were wise as we are now, and we may have to exhume that. Our plan addresses leaving it where it is for another 10 years, monitoring it carefully——

Senator JOHNSTON. Is that liquid waste?

Mr. ROSER. No, it is solid waste. It is simply buried in the ground.

Senator JOHNSTON. What form is it in?

Mr. ROSER. It is various things. It is solids, such as, oh, equipment that is slightly contaminated, rubber gloves, tools that have been used, things that have been contaminated with transuranic elements that are not high level. They aren't dangerous if they are enclosed.

The high-level waste is indicated down below there. That is currently in the form of liquid waste or calcined dry waste.

DEFENSE WASTE PROCESSING FACILITY

Also in the budget for this year is the second increment of funding for the Defense Waste Processing Facility at Savannah River, which will begin to solidify the high-level waste into a borosilicate glass form, put it in sealed containers where it can be stored pending the operation of a geologic repository, either a commercial——

Senator JOHNSTON. Or monitored retrievable storage.

Mr. ROSER. In essence, we will have monitored retrievable storage pending the geologic storage. But it will indeed require our high-level waste in Savannah River first be put in a form where it can be benignly stored in that form for a number of years.

Senator JOHNSTON. What is the status of the design form for the MRS at Savannah River?

Mr. ROSER. It is actually a different concept, Mr. Chairman, than MRS for commercial waste. The defense high-level waste—and I will show you a chart here in just a moment—it has a much lower level of radioactivity because it has been reprocessed. We have utilized the uranium and plutonium from this waste, and this is the residue, so it has a lower level of radioactivity. It is in liquid and sludge and salt form, so it needs to be solidified so that it isn't leachable and put in containers. Once that is done, it can be stored in a less sophisticated facility than a monitored retrievable storage facility for unreprocessed spent fuel rods, but it is, in essence, just put in a concrete warehouse. It doesn't generate too much heat and it can be left there for a period of years until the geologic repository is available.

This is a little bit different than the concept of monitored retrievable storage for unreprocessed spent fuel from civilian reactors. The heat load here is much lower. It is in a much more benign form. But the idea is basically the same. It is temporary storage until you put it in geological formation.

[See chart 63 on p. 1152.]

HIGH-LEVEL WASTE INVENTORY

Mr. ROSER. Just to give you an idea on that, here is the high-level waste inventory as of right now, which shows that the defense portion of the high-level waste in terms of volume is 98 percent of the volume in this country at the present time. In terms of reactivity—in other words, the radioactivity of the material—it is only 13 percent of the total in the country at this time.

In the year 2000, although we will still have 92 percent of the volume, we will have only 4 percent of the radioactivity in terms of the reprocessed residues from reprocessing reactor fuels.

[See chart 42 on p. 1146.]

VERIFICATION AND CONTROL TECHNOLOGY

Mr. Roser. I will finish up here very quickly. We are involved in verification and control technology activities. Principally that is the development of hardware to monitor nuclear weapons activities under various treaties and compliance with those treaties and the control of nuclear-related exports in connection with our nonproliferation treaties, technical and analytical support for nuclear arms control, and the intelligence components of the Department of Energy, which essentially is utilization of the expertise of our Department of Energy laboratories in furthering the mission of the intelligence community.

We produce hardware for the various satellites; that is, sensors, the Vela satellites, some of which are still operating which are in 110,000-kilometer circular orbits and the 20,000-kilometer circular orbit and the satellites. We provide the nuclear sensor packages that actually fly on all of those satellite systems.

[See chart 47 on p. 1148.]

Mr. Roser. Next we have the safeguards and security program. This program is to assure adequate protection for nuclear weapons and devices, nuclear materials, facilities, and classified information under DOE control, and to participate in programs of international cooperation designed to minimize the risk of proliferation of nuclear weapons in support of the nonproliferation program. The budget for this program is about $52 million.

We also conduct the security investigations program to insure that granting access to classified information on special nuclear material will not endanger the common defense and security. That program is about $29.5 million.

That completes my testimony, Mr. Chairman.

QUESTIONS SUBMITTED FOR THE RECORD

Senator Johnston. Thank you very much, Mr. Roser. I have a great many questions prepared by the subcommittee staff; in fact, too many to ask you orally. But they are excellent questions. I would appreciate it if you would respond to those in writing.

Mr. Roser. We would be very happy to.

[The questions and answers follow:]

QUESTIONS SUBMITTED BY SENATOR HATFIELD

General

Question: The defense activities budget has increased from \$3.7 billion in FY 1981 to \$6.7 billion in FY 1984. Please explain the problems being experienced in managing a program growing at this rate.

Answer: Although total funding levels for defense activities has grown over 80 percent since FY 1981, the real program growth has been consistent with planned program objectives and goals and rather modest averaging of about 12 percent over the last three years after taking inflation into account. Because the long-term defense program goals are clearly defined through such documents as the Nuclear Weapons Stockpile Memorandum, the pain of program growth can be minimized through proper program planning. This does not mean that technical and administrative problems are not encountered. We are dealing with state-of-the-art technology in all areas of research, development, testing, and production programs, so unanticipated technical problems cannot be avoided. The primary cause of the problems experienced to date in managing these growing programs has not resulted from unanticipated technical problems; but rather, has been the result of unanticipated funding constraints imposed after projects and programs are on the critical path. Such disruptions are not only difficult to manage, but are very costly to the taxpayer.

In some areas, such as our facilities restoration program, logic would dictate even larger increases than have been requested. However, the growth has been held down to a level that we believe is orderly and manageable in light of operational considerations and the availability of construction contractors.

Question: You proposed a reprogramming, which was approved by the Subcommittee, to accelerate the completion of a number of safeguard and security projects. Please describe the security concerns which justify this action. Have these security concerns also affected the level of your FY 1984 budget request?

Answer: We have reevaluated the importance of our security projects. Because of the significant increase in protest activities at the Department of Energy weapons sites and the increase of international terrorism acts, we are concerned that sabotage or terrorism could, in the future, happen in the United States. An indication of the increase of protest activities is the record of increasing demonstrations and arrests. In CY 1981 there were 11 demonstrations at Department of Energy weapons sites which resulted in 16 arrests. There was a significant increase during CY 1982 which amounted to 57 demonstrations and about 1,400 arrests. The increase in international terrorism was highlighted by (1) the recent sabotage of a nuclear reactor at Koeburg, South Africa; (2) the assassination of the Chief Engineer at the Lemoniz, Spain, nuclear reactor; and (3) the kidnapping of General Dozier, Deputy Chief of Staff, NATO. This security evaluation was considered in preparation of the FY 1984 budget request.

Question: What major problems do you anticipate in meeting the current Nuclear Stockpile Memorandum?

Answer: [Deleted.]

For the Materials Production area, we believe that we would essentially meet all materials requirements provided that adequate funds are available to maintain on schedule our planned production initiatives such as conversion to higher productivity cores, blending, Special Isotope Separation, L Reactor, PUREX, and the Restoration Program. [Deleted.]

Question: Explain the importance of retired weapons as a source of special nuclear material--and the reason why the retirements [deleted].

Answer: When nuclear weapons are retired, the warheads are disassembled and the nuclear materials recovered, processed, and fabricated into parts for new warheads entering the stockpile.

[Deleted].

Weapons retirement schedules are developed and implemented in a manner consistent with Department of Defense deployment requirements. Generally, weapons are retired as new systems are produced to replace them, or as they become obsolete.

[Deleted].

Question: What is the status of the L Reactor restart at Savannah River? Describe the status of the lawsuit and the impact of the potential delay in restart on materials production requirements.

Answer: The L Reactor at Savannah River operated from 1954 to 1968 and was placed in standby status in 1968. The upgrade of L Reactor was initiated in April 1981 to support a potential October 1983 restart. The upgrade of L Reactor is on schedule. The design and procurement efforts are more than 90 percent complete. Construction is 74 percent complete.

An Environmental Assessment was completed and issued in August 1982 in accordance with Council on Environmental Quality regulations and Department of Energy guidelines implementing the National Environmental Policy Act. The environmental impact was not significantly different from that experienced during previous operation. Based on this assessment, a Finding of No Significant Impact was issued by the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness on August 20, 1982.

The Natural Resources Defense Council, Inc., (NRDC) and others filed suit on November 8, 1982, asking for preparation of an Environmental Impact Statement (EIS) and termination of L Reactor project activities. The State of South Carolina joined the suit on January 12, 1983. The Department of Energy answer was submitted to the court on January 7, 1983, denying the allegations and requesting that the complaint be dismissed. NRDC interrogatories were received on January 27, 1983, and the Agency's response was provided on March 4, 1983. A hearing on the environmental effects of L Reactor restart was held before the Senate Armed Services Committee on February 9, 1983. DOE submitted to the Committee responses to all concerns raised at the hearing on February 16, 1983. Senators Thurmond and Mattingly have requested DOE to undertake an extended public review process based on the record of the February 9, 1983, hearing. The Department plans to undertake this review process.

If DOE were unsuccessful in the pending litigation, two possibilities exist. If the court permitted restart of the reactor in parallel with preparation of an EIS, no schedule impact would occur. If, however, restart were not permitted while an EIS was being prepared, a delay beyond the October 1983 date would occur.

[Deleted.]

Question: What is the status of the Defense Waste Processing Facility (DWPF) at Savannah River? Explain the need for $102 million increase for DWPF in FY 1984.

Answer: Firm design for the DWPF has been underway since FY 1981 and is about 20 percent complete. All key process steps have been demonstrated with actual Savannah River waste and key equipment has been demonstrated at one-half scale or greater with simulated waste. We have completed all National Environmental Policy Act documentation on the project including selection of the waste form, borosilicate glass. We have prepared the site and will begin construction of the DWPF in FY 1984. The least expensive way to build a facility is to get on with the job when the groundwork has been laid. The increase of $102 million allows the construction to proceed most cost effectively. A lower level would stretchout the project, increase the cost to complete it, and would require two more tanks per year to be built to manage new waste while we wait for the DWPF. These tanks would, of course, be used for only a fraction of their design life. Site preparation and excavation work will begin in second quarter FY 1984 and subcontracts will be awarded for construction of the main process building, canister storage building, electrical distribution system, and other construction support facilities. Procurement will begin on major equipment such as the glass melter, process cell crane, and other construction materials.

W87 - MX Warhead

Question: Please describe the status of the Administration's efforts to find a basing mode for MX.

Answer: President Reagan, as required by the Congress, submitted his plan in November 1982 for basing 100 PEACEKEEPER missiles in super-hardened, vertical silos in the closely spaced basing mode. He selected Warren Air Force Base near Cheyenne, Wyoming, as the basing area. Unlike the MINUTEMAN, the PEACEKEEPER has the prompt, hard target kill capability necessary to retaliate effectively against the most highly valued and increasingly hard Soviet targets. The closely spaced basing mode is designed to enhance deterrence by denying the Soviets the ability to carry out a confident first strike.

The Congress has taken action on the FY 1983 budget request for PEACEKEEPER, however, and required the President to submit a report on alternatives not earlier than March 1, 1983. By Executive Order on January 3, 1983, President Reagan established the President's Commission on Strategic Forces and charged it with examining the entire Strategic Modernization Program and particular reference to the Intercontinental Ballistic Missile system and basing alternatives for that system. The Commission is to report to the President by next month.

Question: What is the likelihood that a new concept will be proposed such as a smaller missile and presumably smaller warhead?

Answer: We have no definitive information on which to base a reply to your question. The smaller missile is reported to be one option being addressed by General Scowcroft and the Commission. However, any final decision will be made by the President in collaboration with the Congress.

Question: What impact will the new MX proposals have on the FY 1983 and FY 1984 budgets?

Answer: Until the specific recommendations and proposals of the Scowcroft Commission are presented and fully understood, it is impossible to provide any assessment of the impact an alternative basing mode would have on the FY 1983 and FY 1984 budgets. However, we are now prepared to proceed with production of the warhead for the MX missile which is independent of the basing mode. We have already asked the Congress for release of appropriated FY 1983 funds so that we may maintain the MX warhead delivery schedule as well as the schedules of other warheads that depend on facilities to be used initially for MX production.

Question: We are now producing warheads for the LANCE missile and the 8-inch artillery projectile, but the President has ordered their storage in the United States. When do you expect a decision to be made on the deployment of these weapons in Europe?

Answer: The President has decided to produce enhanced radiation warheads and to store them in the United States. We understand that deployment of these warheads on NATO territory will require full consultation with, and the approval of, our NATO Allies. It is also our understanding that there are currently no plans to deploy these warheads anywhere but within the United States and that the Department of Defense is studying alternative actions.

Question: What percentage of weapons-grade material is tied up in the old weapons?

Answer: The DELETED W33 rounds currently in the stockpile contain approximately DELETED of highly enriched uranium (oralloy), which is about of the total oralloy stockpile of DELETED Approximately W33 rounds will be retired during FY 1983, which will return about DELETED of oralloy to the stockpile. The current retirement schedule for the W33 meets the Department of Energy requirements for reclamation of the highly enriched uranium.

Question: Is retirement of projectiles and missiles in Europe contingent on deployment of the modern replacements (W79 projectile and W70 LANCE)?

Answer: The LANCE missile system, with the nonenhanced radiation version of the W70 warhead, was deployed with U.S. forces in Europe as a replacement for the SERGEANT and HONEST JOHN missile systems. The SERGEANT system has been completely retired, and the HONEST JOHN system has also been retired from the U.S. inventory. It is operational now It is also our understanding that retirement of W33 warheads, the present 8-inch artillery fired atomic projectile (AFAP), must be linked with deployment of an improved 8-inch AFAP (the W79). The Department of Defense attaches greater importance to the replacement of obsolescent AFAP's than the deployment of the enhanced radiation W70-3 warhead for LANCE.

Question: If these warheads are not retired, and the weapons material is not recaptured, what impact would this have on future materials production capability and budgets?

Answer: If the W33 warheads in the stockpile at the end of FY 1983 are not retired, approximately DELETED of highly enriched uranium (equivalent) will not be made available for recycle into other warheads as currently projected. It would take the Department of Energy uranium enrichment complex about DELETED to make up that quantity at a cost of about DELETED

Question: If the full number of W70 and W79 now proposed are deployed in Europe, is there a need for the planned W82, 155mm artillery projectile?

Answer: It is our understanding that there is a need for the modern W82 155mm artillery fired atomic projectile. Both the Secretary of Defense and the Supreme Allied Commander Europe have recently reaffirmed the necessity for the W82 if we are to meet our national security requirements and commitment to our NATO Allies.

The W82 is scheduled to replace the W48 (fielded in 1967) on a one-for-one basis. The W82 has vast improvements in accuracy, fuzing, yield, safety, reliability, reaction time, range, and command and control. [Deleted].

The fielding of a new W82 155mm nuclear system is viewed as a credible threat by the Soviets and would increase their targeting problem [deleted].

[Deleted] Also, because the number of 8-inch howitzers that NATO Allies possess is so small, the targeting problems for the Soviets are much simplified in their sector of the battlefield. Unless these Allies can also be armed with the W82 for their 155mm artillery, their only nuclear system is extremely vulnerable.

Question: [Deleted.]

Answer: [Deleted.]

Question: [Deleted.]

Answer: [Deleted.]

Research, Development, and Testing

Question: Briefly discuss the achievements in the advanced development program over the past few years?

Answer: We believe we have made significant progress in improving our understanding of the operation of nuclear devices and our ability to meet Department of Defense (DOD) requirements for lesser weight, smaller diameters, and better response to the demands of safety, security, and command and control.

Specifically, we have made advances in the areas of compact implosion systems, insensitive high explosive, [deleted] radiation-hard microelectronics, and improved diagnostic and calculational capabilities.

Our first priority must always remain that of striving to be in a position to be responsive to the needs of the DOD. That means we must investigate and develop those design concepts applicable to warheads for systems projected for near-term development by the DOD. As a second priority, we look at the feasibility of advanced concepts in support of longer-term developments such as the nuclear-driven x-ray laser [deleted] improvements in the understanding of weapons physics and chemistry, advances in materials sciences, and improved safety, security, and command and control systems.

Question: Describe the progress being made on advanced concepts now under development, particularly the x-ray laser?

Answer: [Deleted]. The term "new concepts" applies to nuclear explosive technologies and military applications that are conceptually different from traditional practice. As such, this is a broad-based technology campaign involving virtually all aspects of our technology base.

[Deleted].

Looking at base case funding levels for new concepts of about $90 million in FY 1983 and $120 million in FY 1984, we are now examining various program and resource strategies for pursuing a long-term balanced but aggressive campaign on these concepts. We will keep the Congress currently and fully informed as to our progress.

Question: Why do you need another 80 positions in research and development in FY 1984 and an additional $19.7 million?

Answer: This increase in research and development employment and funding is necessary in view of the decline of approximately 35 percent in this area throughout the seventies and the current urgent requirement to support an expansion of effort in the technology base area. In particular, emerging new concepts work requires a significant expenditure for goods and services which are incremental to and different from our more traditional procurements.

The fully loaded cost per research and development full-time equivalent in FY 1983 is $81,500. The fully loaded cost per full-time equivalent in FY 1984, less escalation and the increase in computer leases, is $83,200. Based on these figures, the cost of providing the additional 80 full-time equivalents is about $6.7 million. The remaining $13.0 million of the $19.7 million provides an improved mix of procurements to employment for the remaining 7,870 full-time equivalents, or an average increase of just under $1,700 per full-time equivalent.

Question: Provide a distribution of positions by laboratory for FY 1982, FY 1983, and FY 1984 and the current level of employment for each.

Answer: The following table shows weapons research and development employment for the period FY 1982 to FY 1984.

Weapons Research and Development Employment

(Total Full-Time Equivalents)

	FY 1982	FY 1983	3/31/83	FY 1984
Lawrence Livermore National Laboratory	2,439	2,410	2,473	2,390
Los Alamos National Laboratory ...	1,906	2,020	1,925	2,050
Sandia National Laboratories	3,260	3,290	3,350	3,360
Other	150	150	150	150
Total	7,755	7,870	7,898	7,950

Question: Describe in detail the need for and what will be accomplished with the operating expense increases in FY 1984 for the testing program.

Answer: Almost half of the test program operating increase in FY 1984 is needed to cover escalation estimated at about 7 percent. The remaining increase of about $35,000,000 is necessary to support a modest increase in the level of testing and data returned to the program, as well as preparation for continued modest growth in future year test programs.

[Deleted].

Although this will contribute to increased test costs, the data returned to the overall weapons program will contribute significantly to progress in this area.

Question: Please describe the need for a 75 percent increase in testing capital equipment from FY 1982 to FY 1984.

Answer: About 70 percent of the growth noted for testing capital equipment during the three-year period relates to the effects of inflation and the one-time budgetary impacts of the major items of equipment included in the FY 1984 budget request--the security helicopter, cable downhole system, and distributed network equipment. The balance of the growth provides an increase in real purchasing power of about $5.8 million for capital equipment over the three-year period. This represents about a 5 percent increase from FY 1982 to FY 1984 or about 2.5 percent per year.

This real growth is necessary for two reasons. The first is to keep pace with the growth in the number and complexity of device tests during this period. Adequate state-of-the-art equipment is crucial to the successful execution of the underground test program, particularly in the area of data return. Equipment failures at crucial moments can be extremely costly--both in terms of sunk costs and data lost to the program.

The second has to do with the history of equipment underfunding in the test program. As noted in previous years' testimony, equipment underfunding, particularly during the 1970's, has resulted in a serious deterioration problem in terms of the physical age and the technical obsolescence of our test equipment. Our restoration initiative has been designed to address this problem and we appreciate your continued support for this initiative. However, concurrent real growth in the funding level for basic equipment and general plant projects is essential if we are to avoid a future recurrence of the same circumstances that created the need for the present restoration initiative.

Restoration and Revitalization

Question: Describe the need to initiate a $600 million nuclear testing facility revitalization program.

Answer: The history of the test program has been one of great fluctuations and very dynamic programs. These program changes over the years have been due to political considerations and shifts in national policy relating to nuclear testing and nuclear deterrence. Many of our testing facilities are temporary, were built 20 years ago, and are now completely overage and deteriorated. Many of the facilities now in use were built for other purposes. In addition, the increased complexity and workload confronting the program severely aggravates this situation. A decade of decline in testing and minimal construction funding for testing has created a large backlog of critically needed facilities and equipment to support future weapons development. The Administration has supported a policy directed toward a long-term, high-level, balanced test program.

[Deleted].

Question: Describe the activities that will be performed with the $38.5 million included in the FY 1984 budget for nuclear testing facilities revitalization.

Answer: The funding requested for FY 1984 represents the first increment of a multiyear program and will be used to initiate the most urgent requirements directly related to the Nevada Test

Site. Future year requests are planned to also include the requirements of the three weapons laboratories. The $38.5 million funding for FY 1984 will be used as follows: $3.5 million is for design and land acquisition for the Field Engineering Complex at North Las Vegas; $9 million is for diagnostic test equipment; and $26 million is for test facilities at the Nevada Test Site which includes the Event Power System Upgrade - $3.5 million, a Field Operations Office - $2.4 million, the paving of Pahute Mesa Road - $5.0 million, a Forward Area Assembly Tower - $5.4 million, a North Las Vegas Staging Assembly Tower - $6.6 million, and Mercury Dormitories - $3.1 million.

Question: How does the revitalization program differ from the weapons facility restoration program?

Answer: The test revitalization program provides for the construction of new facilities; modifications, relocations, and additions to existing facilities; and equipment, including the addition of new capability and capacity at the three weapons laboratories and the Nevada Test Site. The restoration program provides for the replacement of existing utilities and equipment that, in progressing at their normal life cycle, have deteriorated to the point that their physical condition is poor or is no longer technically adequate. The restoration program includes the seven weapons production plants, the three laboratories, and the Nevada Test Site.

Question: How much is included in the weapons program budget to perform restoration, revitalization, and prevention of plant deterioration?

Answer: A total of $786,200,000 is included in the weapons program FY 1984 budget to perform restoration, revitalization, and prevention of plant deterioration.

Question: Provide a listing covering FY 1981, FY 1982, FY 1983, and FY 1984 showing the amounts for restoration, revitalization, and prevention of plant deterioration.

Answer: The funding for restoration, revitalization, and prevention of plant deterioration follows.

(B/A $ in Thousands)

	FY 1981	FY 1982	FY 1983	FY 1984
Restoration	$ 74,800	$144,000	$154,400	$229,200
Revitalization	0	0	0	38,500
Prevention of Plant Deterioration--Includes GPP, Capital Equipment, and Maintenance	287,500	363,000	419,700	518,500
Total	$362,300	$507,000	$574,100	$786,200

Question: Please provide for each restoration activity by location the amount appropriated to date, the amount obligated to date, the amount committed to date, and the amount costed to date.

Answer: A summary of funding for restoration by location follows.

(Dollars in Thousands)

	Period through January 31, 1983			
Site	Appropriated a/	Obligated b/	Committed b/	Costed b/
Y-12 Plant	$139,800	$ 76,500	$ 56,800	$ 32,700
Rocky Flats Plant	58,500	58,500	40,800	26,400
Bendix Plant	60,300	42,300	35,800	24,200
Mound Facility ..	26,000	22,200	18,700	13,300
Pantex Plant	11,700	4,200	1,900	1,300
Pinellas Plant ..	10,100	8,100	5,000	3,100
Savannah River Plant..........	8,100	6,700	1,200	600
Lawrence Livermore National Lab. .	24,700	16,500	15,200	11,500
Los Alamos National Laboratory	26,000	21,600	18,000	10,400
Sandia National Laboratories ..	27,000	22,600	16,500	12,100
Nevada	39,500	22,400	22,400	13,700
Total	$431,700	$301,600	$232,300	$149,300

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a/ Does not include FY 1984 funding request.

b/ Continuing resolution action for FY 1983 delayed allotments to the field.

Major Construction Projects

Question: Provide for the record, a table detailing the status of each major construction project now underway. Show the project number, description of project, total estimated cost, authorization to date, appropriation to date, 1983 appropriation, 1984 request, obligations to date, commitments to date, percentage of completion, and expected final costs. Please group projects by location.

Answer: This information is presented in a table which I am providing for the record.

Table I
Major Projects Underway

(Dollars in Thousands)

Project Number	Title	Total Estimated Cost	FY 1983 Appropriation	FY 1984 Requested Appropriation	Period Through January 31, 1983					Percent Completed	Estimated Final Cost
					Authorization	Appropriation	Obligated	Committed	Costed		
82-D-107	Utilities and Equipment Restoration, Replacement, and Upgrade, Various Locations	$1,036,000 a/	$154,400	$229,200	$431,700	$431,700	$301,600	$232,300	$149,300	22.4	$1,036,000
	Y-12 Plant		56,000	97,700	139,800	139,800	76,500	56,800	32,700		
	Rocky Flats Plant		19,200	34,900	58,500	58,500	58,500	40,800	26,400		
	Bendix Plant		16,200	0	60,300	60,300	42,300	35,800	24,200		
	Mound Facility		5,900	2,200	26,000	26,000	22,200	18,700	13,300		
	Pantex Plant		9,900	11,500	11,700	11,700	4,200	1,900	1,300		
	Pinellas Plant		5,200	0	10,100	10,100	8,100	5,000	3,100		
	Savannah River Plant		2,000	1,700	8,100	8,100	6,700	1,200	600		
	Lawrence Livermore National Laboratory		8,000	19,200	24,700	24,700	16,500	15,200	11,500		
	Los Alamos National Laboratory		8,500	18,700	26,000	26,000	21,600	18,000	10,400		
	Sandia National Laboratories		9,000	19,300	27,000	27,000	22,600	16,500	12,100		
	Nevada		14,500	24,000	39,500	39,500	22,400	22,400	13,700		

Description: This project provides for the replacement of utilities and equipment that, in processing at their normal life cycle, have deteriorated to the point that their physical condition is poor or is no longer technologically satisfactory.

Project Number	Title	Total Estimated Cost	FY 1983 Appropriation	FY 1984 Requested Appropriation	Authorization	Appropriation	Obligated	Committed	Costed	Percent Completed	Estimated Final Cost
81-0-101	Particle Beam Fusion Accelerator II Sandia National Laboratories, Albuquerque, New Mexico	Under study	4,250	12,900	39,250*	31,750	27,450	24,890	5,393	35.7	Under study

Description: This project is for the construction of a light ion accelerator that will produce 3.5MJ of energy and a peak power of 100TW in the load, included in the project is the necessary laboratory space and utilities to house and support the accelerator.

*Includes 2,500 in PE&D funds.

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a/ This amount also includes the total estimated costs of the following prior-year utilities and equipment restoration projects: 81-D-116, 81-D-107, 80-AE-6, and 79-7-n.

Major Projects Underway
(Dollars in Thousands)

Project Number	Title	Total Estimated Cost	FY 1983 Appropriation	FY 1984 Requested Appropriation	Period Through January 31, 1983 Authorization	Appropriation	Obligated	Committed	Costed	Percent Completed	Estimated Final Cost
81-T-105	Defense Waste Processing Facility Savannah River, South Carolina	$910000	$40000	$142000	$76965	$76965	$46415	$6177	$39772	Design 17%	$910000

Description: This project will provide facilities for solidifying the high-level radioactive waste at the Savannah River Plant for temporary storage on-site, and for transportation to, and disposal in a federal repository.

Project Number	Title	Total Estimated Cost	FY 1983 Appropriation	FY 1984 Requested Appropriation	Period Through January 31, 1983 Authorization	Appropriation	Obligated	Committed	Costed	Percent Completed	Estimated Final Cost
77-13-f	Waste Isolation Pilot Plant, Delaware Basin Southeast, New Mexico	$504000	$110800a/	$59300b/	$233800	$233800	$133264	$6610	$120673	24%	$504000

Description: This will be a research and development facility to demonstrate the safe disposal of radioactive wastes from defense activities and programs of the United States exempted from regulation by the Nuclear Regulatory Commission.

a/ Includes $50 million proposed for deferral until FY 1984 due to possible delays in Administrative Land Withdrawal.

b/ If Administrative Land Withdrawal is received by July 1983, an amendment of approximately $50 million will be submitted.

Materials Production
Major Construction Projects
(Dollars in Thousands)

Location	Project Number	Project Title	Total Est. Cost	Auth. to Date	Appr. to Date	FY 1983 Appr.	FY 1984 Request	Obs. to Date	Comm.[1] to Date	% Comp.	Expected Final Cost
Idaho	77-13-a	Fluorinel Dissolution Process and Fuel Receiving Improvements (FAST)	$200,000	$200,000	$200,000	$ 10,000	$ 0	$190,000	$161,000	91%	$200,000
Savannah River	81-D-143	L Reactor Upgrade	134,000	134,000	134,000	36,500	0	97,500	90,200	74%	134,000
Multiple Sites	81-D-128	Restoration of Production Capabilities, Phase I	50,400	50,400	50,400	10,100	0	49,400	24,826	48%	50,400
	82-D-124	Restoration of Production Capabilities, Phases II - V	359,600[2]	134,700	134,700	89,700	118,600	117,862	33,078	6%	359,600

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[1] Defined as costs-to-date plus outstanding commitments.

[2] Includes Phase V of the Restoration effort. The current project includes Phases II through IV only.

Fluorinel Dissolution Process and Fuel Receiving Improvements, FAST - The FAST Project provides for the construction of a new headend facility at the Idaho Fuel Processing Facility (IFPF) to receive, handle, store and dissolve a variety of irradiated nuclear fuels for which no capability currently exists. The facility, in conjunction with other facilities at the IFPF, will process new naval nuclear propulsion fuels and recycle the recovered uranium to fuel the DOE production reactors at Savannah River.

L Reactor Upgrade - This project includes repairs and modifications to L Reactor to provide reactor operations, safety, environmental protection, cooling, and target handling comparable to the three current operating reactors.

Restoration of Production Capabilities - This project consists of several hundred separate construction or repair activities to correct physical deterioration that has accumulated as a result of the aging of DOE's nuclear materials production plants at Savannah River, South Carolina; Richland, Washington; Fernald, Ohio; and Oak Ridge, Tennessee. Due to the size and nature of this undertaking, work has been divided into two separate line items.

SENTRY/LoAD System

Question: Please describe the purpose behind the SENTRY/Low Altitude Defense (LoAD) System and the need for initiating Project 83-D-134 in FY 1984.

Answer: The purpose of SENTRY (formerly LoAD) is to enhance the survivability of intercontinental ballistic missiles by actively defending silos and SENTRY defense modules.

We have been informed by the Department of Defense that its Ballistic Missile Defense program is being reoriented to emphasize long-term research and development and to provide a near-time hedge options which allows defense of PEACEKEEPER in the early 1990s in the event that defense should become necessary.

Regarding initiating the project in FY 1984, initial funding for the construction project is required in FY 1984 in order to complete the facilities in time [deleted]. First quarter FY 1984 funding will permit construction to be completed [deleted].

Question: [Deleted].

Answer: [Deleted].

Question: How much in FY 1984 will be used for design work and how much for long-lead procurement?

Answer: Of the $16,300,000 requested for SENTRY in FY 1984, approximately $3,900,000 would be directed to architect-engineer efforts at Rocky Flats, Mound, Pantex, Y-12 Plant, and the Bendix Plant. The remaining $12,400,000 is scheduled for long-lead equipment procurement at these sites.

Question: What is the total estimated cost of the effort for SENTRY including expenditures to date, total estimated cost for Project 83-D-134, total estimated operating expenses, both direct and indirect for the project in future years, and other costs?

Answer: Complete cost information of the type requested is developed after agreement is reached with the Department of Defense to proceed with Phase 3 full-scale development of a weapon system with definitive military characteristics. The cost estimates developed to date were based on preliminary military characteristics provided by the Department of Defense.

The total estimated cost of Project 83-D-134, SENTRY warhead production facilities, various locations, is $72 million. No appropriations have been provided for this project; hence, there have been no expenditures to date.

In FY 1983, we are estimating a cost of $2.2 million for production process development effort. In FY 1984, we are projecting a total expenditure of $51.6 million, including $21.2 million for research and development, $14.1 million for process development and initial production testing, and $16.3 million to initiate design and construction on the new production facilities.

Question: Have there been changes from FY 1983 in design, production methods, or production schedule for the system?

Answer: The range of warhead types has been fairly constant throughout the conceptual and feasibility studies. At present there are about nine candidate warhead designs.

Question: What impact would a decision not to proceed with MX or to proceed with a smaller, mobile MX missile have on the need for the project?

Answer: Some of the design details of SENTRY are subject to the details of the ultimate MX basing mode as well as the threat. However, even if MX never comes to fruition, there will continue to be a need for a viable ballistic missile defense in order to protect against a Soviet ballistic missile defense breakout.

W79 8-Inch AFAP

Question: [Deleted.]

Answer: [Deleted.]

Question: [Deleted.]

Answer: [Deleted.]

Question: When do you believe the W79 will be deployed in Europe to counter the Soviet tank threat?

Answer: The President has decided to produce enhanced radiation warheads and to store them in the United States. I understand that deployment of these warheads on NATO territory will require full consultation with, and the approval of, our NATO Allies.

Question: If the W79 and the W70 are unacceptable to our NATO Allies and are not deployed in Europe, what will be the mission of these weapons?

Answer: Deployment depends upon consultations with the Allies to discuss deployment options. NATO has established requirements for a modernized 8-inch warhead. The enhanced radiation capability of both the W79 and new LANCE W70 warheads provides our forces, on a worldwide basis, a much more effective capability and thus a more credible deterrent to major conflict. The significant expansion of Soviet short-range nuclear force capabilities is a concern which must be considered in future deployment decisions.

Question: How quickly could these weapons be deployed in Europe from their present U.S. location?

Answer: It is our understanding that, under emergency conditions with the proper coordination and approval of our NATO Allies, warheads could be moved [deleted] depending on the priority assigned to this matter.

Question: How much weapons-grade material is now tied up in the older W33 which is scheduled to be replaced by the W79?

Answer: Approximately [deleted] of highly enriched uranium (equivalent) is currently tied up in the W33 warheads.

Question: Please provide the schedule for retirement of the W33.

Answer: Below is the retirement schedule for the W33. These plans, however, may have to be adjusted in accordance with future W79 deployment decisions. This schedule meets Department of Energy requirements for weapons-grade material reclamation.

W33 at beginning of Fiscal Year

[Deleted.]

Retirements during Fiscal Year

W33 at end of Fiscal Year

Question: If the older warheads are not retired, what is the impact on future supply of weapons materials and the materials production facilities? What will be the specific impact?

Answer: If the W33 warheads in the stockpile at the end of FY 1983 are not retired, approximately [deleted] of highly enriched uranium (equivalent) will not be made available for recycle into other warheads, as currently projected. It would take the Department of Energy uranium enrichment complex to make up that quantity at a [deleted].

W80 ALCM Warhead

Question: Will you propose a further reduction in the total builds of the air launched cruise missile (ALCM)/W80? Be specific.

Answer: As is the case with all weapon systems, it is the Department of Defense's responsibility to develop ALCM force-level requirements. The Department of Energy, therefore, does not plan to propose a change to ALCM warhead quantities given in the FY 1983-1988 Nuclear Weapons Stockpile Memorandum. We are aware of some of the force-level analyses being performed within the Department of Defense and would expect to be notified if any change of warhead quantities is necessary.

Question: How would this change effect the FY 1984 budget request?

Answer: As stated above, we have not been officially notified of any changes. The effect on the FY 1984 budget request cannot be determined until we know the magnitude of any proposed change. When completed, the deployment analysis being performed by the Department of Defense might indicate the need for a change in warhead quantities. [Deleted].

Question: Explain any efforts or discussions underway that would accelerate the Advanced Cruise Missile Technology warhead study?

Answer: We know of no efforts to accelerate the Advanced Cruise Missile Technology warhead study.

Question: Will you need more funding than requested in FY 1984 for the Advanced Cruise Missile warhead program?

Answer: Since the Advanced Cruise Missile will use the current W80-1 Air Launched Cruise Missile warhead, it appears that no additional FY 1984 funding would be required.

W85 - PERSHING II Warhead

Question: Has the sequence of the planned flight tests been changed, and what impact does this have on DOE's warhead development?

Answer: The PERSHING II engineering development flight test plan has changed. However, the warhead engineers are working with the missile engineers to insure that all of the objectives of the flight test program are achieved.

The impact on the warhead development has been that confirmation of the compatibility of the warhead with the missile has been delayed. The Department of Energy has been able to accommodate the compression of the PERSHING II flight test plan with minimum disruption.

Question: Has the 3-month delay in conducting the first flight test, combined with its failure, extended the December 1983 initial operational capability date (IOC)?

Answer: The initial operational capability (IOC) date of December 1983 has not changed. The flight test schedule was compressed to support the IOC date. With the recent successes, the PERSHING II/W85 should have no problem achieving IOC.

Demolition Munitions

Question: Please explain the need for, the yield, the size, and other capabilities of the W45 Medium Atomic Demolition Munition (MADM) and the B54 Special Atomic Demolition Munition (SADM).

Answer: Atomic Demolition Munitions continue to play a useful role in NATO's deterrent posture because they are a factor which the Warsaw Pact would have to take into account in developing its war plans, gauging overall chances for military success, and deciding the fundamental issue of whether to initiate an attack.

In the future, however, as new, more effective, conventional obstacle munitions become available and are deployed, the need for Atomic Demolition Munitions should diminish. Atomic Demolition Munitions will be retained in the NATO nuclear inventory as long as their useful stockpile life permits.

The Medium Atomic Demolition Munition has limited utility and will be phased out of the NATO inventory by [deleted] The Special Atomic Demolition Munition will be retained in the NATO inventory until the end of its useful stockpile lifetime in the [deleted]. The Special Atomic Demolition Munition has [deleted] can produce desired obstacles with minimum collateral damage. It is man-portable and weighs pounds. [deleted]

Question: How many of these weapons are stockpiled, where, and what are their useful life and their schedule for retirement?

Answer: The number of W45 Medium Atomic Demolition Munition and the B54 Special Atomic Demolition Munition now stockpiled, where located, their useful life, and schedules for retirement are as follows:

Question: What specifically is the role in NATO's deterrence posture of the SADM?

Answer: Special Atomic Demolition Munitions enlarge the range of nuclear options available to NATO and, therefore, contribute to the credibility of the deterrent. The existence of Special Atomic Demolition Munitions in the stockpile and the possibility of their use would be one of the many factors the Warsaw Pact would take into account when considering whether to launch an attack on NATO. Special Atomic Demolition Munitions are employed to create a specific kind of obstacle. They are an effective and efficient means to [deleted] and they provide a supplement to natural obstacles and obstacles created by conventional munitions.

Weapons Activities

Question: Explain briefly the need for the potential improvement in military capability and the amount requested for each of the Phase 1 and Phase 2 Systems being proposed.

Answer: Phase 1:

The Joint Tactical Missile System (JTACMS; formerly Corps Support Weapons System (CSWS)) will replace the present LANCE missile system and will provide the Corps Commander a nuclear and nonnuclear capability against the second echelon threat.

The Tactical Air-to-Surface Munition (TASM) will be an air-launched nuclear munition for attacking second echelon forces.

The Advanced Intercontinental Ballistic Missile (AICBM) will provide a survivable, small, lightweight, and road/air mobile complement to PEACEKEEPER.

The Air-to-Air Intercept Missile (AAIM) will provide a nuclear warhead for the Phoenix missile, thereby providing a nuclear air-to-air capability for carrier-based aircraft.

The Advanced Air-to-Surface Missile (AASM) will provide a smaller, safer, improved replacement for the Short Range Attack Missile (SRAM).

Phase 2:

The Antisubmarine Warfare/Standoff Weapon (ASW/SOW) will provide replacements for existing submarine-launched, surface-launched, and air-dropped nuclear weapons.

The Trident II will provide a hard target kill capability to be carried aboard Ohio-class SSBNs.

SENTRY will add to the survivability of ICBMs by actively defending silos and SENTRY defense modules.

The Department of Energy does not request funds by system for conceptual (Phase 1) and feasibility (Phase 2) studies. The funds needed to support these efforts are drawn from the Future Weapons line of the budget under Weapons Development, Engineering, and Certification. Funding requirements by weapon are requested when the system enters Phase 3 and a sizeable commitment of resources can be specifically identified.

Question: Provide the Committee with a breakdown of all the stockpiled weapons scheduled for retirement--include the type, number, and year of expected retirement.

Answer: The type, number, and year of expected retirement of those stockpiled weapons are as follows:

[Deleted.]

Question: What new construction is provided in the budget for the Rocky Flats facility? Are there alternatives to this construction?

Answer: The requested information follows:

New Construction at Rocky Flats

New projects for FY 1984 which will provide construction funds to the Rocky Flats plant include:

84-D-112, Trident II Warhead Production Facilities, Various Locations
84-D-113, Antisubmarine Warfare/Standoff Weapon Warhead Production Facilities, Various Locations
84-D-114, Consolidated Nonnuclear Manufacturing Facility, Rocky Flats Plant, Golden, Colorado
84-D-122, Safeguards and Security Upgrading, Rocky Flats Plant, Golden, Colorado

[Deleted.]

Question: [Deleted.]

Answer: [Deleted.]

Question: What amount was included to cover inflation or escalation for operating expenses in the FY 1984 request?

Answer: The FY 1984 operating expenses request includes $77.9 million in research, development, and testing and $130.5 million in production and surveillance to cover inflation.

Question: What percent of the request?

Answer: The amounts included in the FY 1984 request for research, development, and testing and the production and surveillance budgets for escalation represent 7.0 percent and 8.0 percent of their respective total operating expenses requests expressed in FY 1983 dollars.

Question: What allowance for rate of inflation is included in the rest of the Department of Energy budget?

Answer: We have been informed by the Office of the Controller that various escalation rates were used by the Department of Energy program offices. The specific escalation rates used were the result of considering the circumstances applicable to each particular program. Special consideration was given to deflators published by economic research organizations and to actual experience.

Inertial Confinement Fusion

Question: Please explain the $13 million reduction in operating funds in the Inertial Confinement Fusion program.

Answer: The FY 1984 operating level for the Inertial Confinement Fusion program must be viewed in the context of the overall government-wide requirements. This program is competing with some programs which are considered to have a higher priority in a stringent budgetary environment. The requested level will permit us to continue an adequate program directed toward demonstrating the feasibility of inertial confinement fusion using lasers or particle beams.

Question: Provide a distribution of the FY 1983 and FY 1984 budgets by laboratory, University of Rochester, Naval Research Laboratory, and KMS Fusion, Inc.

Answer: The distribution of the FY 1983 operating funds as designated by Congress and the FY 1984 budget as submitted are as follows:

Distribution of Operating Funds
(B/A $ in Thousands)

	FY 1983	FY 1984
Lawrence Livermore National Laboratory	$ 56,100	$ 53,200
University of Rochester	6,100	5,500
Naval Research Laboratory	2,400	2,200
KMS Fusion, Inc.	10,500	9,500
Los Alamos National Laboratory	41,800	38,200
Sandia National Laboratories, Albuquerque, NM	20,000	18,500
Other	3,100	0
Total	$140,000	$127,100

Question: Is it reasonable to reduce the operating expenses of this program given the first year of operation of ANTARES and the continued HALITE/CENTURION activities in addition to the continuing beam-target experiments?

Answer: While it would be desirable to have a higher funding level considering the first year of ANTARES operation and HALITE/CENTURION activities as well as the ongoing target experiments, the program must be viewed in the context of the overall Government-wide requirements. As was stated earlier, inertial confinement fusion is competing with some programs which are considered to have a higher priority in a stringent budget environment. The requested level will permit us to continue an adequate program directed toward demonstrating the feasibility of inertial confinement fusion using lasers or particle beams.

Question: What is the status of the ANTARES, Particle Beam Fusion Accelerator, and NOVA construction projects?

Answer: ANTARES is fully funded at $62.5 million. The project is within cost and on schedule. The scheduled completion date is the fourth quarter of FY 1983. In FY 1984, the Particle Beam Fusion Accelerator-II is funded at $12.9 million. The total estimated cost and project schedule are under study. The amount appropriated through FY 1983, including plant engineering and design, is $31.8 million. NOVA is fully funded at $176 million. The project is within costs and on schedule. The scheduled completion date is the fourth quarter of FY 1984.

Materials Production

Question: What are the major initiatives required to meet the requirements in special nuclear material required by the current stockpile memorandum?

Answer: The major initiatives that we have underway are the restart of the L Reactor, the restart and operation of the PUREX plant at Richland, the introduction of the Mark-15 high productivity plutonium cores, the restoration of the production complex, the special isotope separation process, and the blending activities that we will be doing prior to the time that the special isotope separation process comes on-line.

Question: What is the status and advantage of the Mark 15 reactor core?

Answer: Since test irradiations were first conducted in 1972, the Mark 15 core charge has been fully developed and provides a high degree of assurance for increased reactor productivity. A full-scale preproduction operation checkout is planned late in fiscal 1983. The requested funding will permit initial operation of one Savannah River reactor in FY 1985.

[Deleted.]

Question: Explain the importance of blending operations and the status of the PUREX and the blending operations?

Answer: Blending activities are essential to meeting near-term weapons stockpile requirements, and are the most cost-effective way of increasing near-term supply of plutonium.

The PUREX reactivation is on schedule for startup by April 1984 or sooner. A final environmental impact statement was issued in February 1983. Cold testing with unirradiated uranium was initiated in FY 1983. All construction projects required for startup are on schedule.

As for blending activities, the Savannah River reactors are now producing high purity 3 percent plutonium-240 plutonium. As high assay blendstock from PUREX and recovered scrap becomes available, these materials will be blended with high purity material from the Savannah River reactors.

Question: Your request provided $70,000,000 for enriched material in FY 1984 but nothing in FY 1983. Why?

Answer: For the first time, the Materials Production budget includes uranium enriching costs for the slightly enriched uranium needed to fuel N Reactor. This amounts to $20,000,000 in FY 1984. In prior years, this material was obtained from existing inventories, which will have been exhausted in FY 1984.

Also included in this request is $50,000,000 for the purchase of slightly enriched uranium from the gaseous diffusion plants to initiate a pipeline of fuel for higher productivity cores for the Savannah River reactors. This fuel will convert the Savannah River reactors to the higher productivity Mark 15 core loading starting in FY 1985.

Question: In FY 1983, $109,000,000 was added to the Materials Production budget by Congress for production of enriched materials for Naval cores. This activity is budgeted for in the Naval Reactors Development program in FY 1984. Explain the rationale for this change.

Answer: The $109,000,000 provided enriched uranium used in manufacturing reactor cores required for the nuclear powered ships in the U. S. Navy. Since the Naval Reactor Development program has managerial responsibility in matters relating to nuclear propulsion of naval vessels the DOE determined that this funding was more appropriately identified with Naval Reactors than with Materials Production activities.

Question: [Deleted.]

Answer: [Deleted.] *DELETED*

Question: [Deleted.]

DELETED

Answer: [Deleted.]

Question: Would you provide an analysis of the cost of recovering plutonium from: (a) the existing reactors, (b) the blending operations, (c) the Mark 15 cores and (d) SIS?

Answer: The unit costs for these options are shown in a table I would like to insert in the record.

Costs of Supply Options

[Deleted.]

These costs are based on the 16 year stockpile planning period of FY 1983-FY 1998, and includes operating, capital, and uranium enrichment costs. The costs for blending and Mark 15 are costs for the additional plutonium produced by these processes.

Question: Provide a breakdown of the various inventory balances for special nuclear materials programs at the end of FY 1982 showing FY 1983 changes and FY 1984 changes.

Answer: This information can best be represented in a table which I am providing for the record. Common use stores inventories are being increased to support L Reactor operation and to improve productivity. Procurement of process spares in FY 1984 is essential to assure continued plant operations in the event of equipment failure, especially in the fuel fabrication, processing, and reactor refueling areas. Special reactor material inventories will continue to be increased as Richland procures zirconium to support the increased finished fuel fabrication required to operate N Reactor on a weapon-grade plutonium production mode.

Changes in Inventories
(BA in $000)

	FY 1982 Ending Balance	FY 1983 Change	FY 1983 Ending Balance	FY 1984 Change	FY 1984 Ending Balance
Common Use Stores	$ 43,957	$- 3,429	$ 40,528	$+ 9,865	$ 50,393
Process Spares	7,000	+ 4,970	11,970	+ 7,640	19,610
Special Reactor Materials	166,797	+15,648	182,445	+13,087	195,532
All Other Special Materials	3,196	+ 29	3,225	+ 533	3,758
Total Inventory Balances	$220,950	$+17,218	$238,168	$+31,125	$269,293

Question: Provide a justification for the $65.6 million included in the FY 1984 budget for inflation.

Answer: The FY 1984 budget includes 7 percent inflation for operating expense and capital equipment. The predicted inflation rate is based on current and anticipated labor agreements, material and equipment price changes, and chemical and nuclear industry indices. Labor costs are approximately 60 percent of the total program costs. Some labor costs are based on labor union contracts currently in force. Other labor costs are based on the wage rates established for comparable industries in the local area.

Question: Describe the need for the $34.9 million increase for reactor operations at Savannah River and Richland.

Answer: The $34.9 million increase in reactor operations is the result of the higher level of program activities required to increase production at Richland and Savannah River in order to support the requirements of current Nuclear Weapons Stockpile Memorandum.

At Savannah River, the increase includes increased costs for fuel fabrication facility maintenance and support activities to provide adequate levels of preproduced inventories of Mark 16/31 fuel and targets;

[deleted]

scheduled reactor maintenance activities such as reactor repairs and river water pumps overhaul; funding for the reallocation of site overhead and site power redistribution costs resulting from the shutdown of the Savannah River heavy water plant in FY 1982; installation of a 230KV power line; contractor telephone system upgrade; manpower for project liaison activities; training; studies of the effect of thermal dispersion within the four reactors; and other miscellaneous items.

At Richland the increases provide funding for numerous activities that are important to the continuing operation of N Reactor, such as, reactor and fuel fabrication maintenance, plant life extension studies, magnetic filter system demonstrations, and augmented production studies.

Question: How much did reactor operations increase in FY 1983 over FY 1982 at Savannah River and Richland?

Answer: Operating expenses for reactor operations increased $28.6 million at Richland and Savannah River from FY 1982 to FY 1983. This mainly reflects the conversion of N Reactor to weapon-grade production which necessitates a more than doubling of the annual fuel fabrication rate to support this mode of operation. The increase in fuel throughput necessitates an increase in reactor and fuel fabrication facility personnel, materials, utilities, and maintenance. The increase also reflects additional fuel fabrication to support L Reactor operation in FY 1984, increased reactor safety activities, initiation of fuel sorting and productivity improvements at Richland, and various miscellaneous items.

Question: Your operating expenses budget has increased 36% over FY 83. What percentage increase is the FY 84 request over FY 82 and why is such an increase in FY 84 justified?

Answer: From FY 1982 to FY 1984 the operating expenses request for Materials Production have increased by 74 percent. The increase you are seeing reflects the planned increases for the major activities begun in FY 1981 as a result of the FY 1981-1983 Nuclear Weapons Stockpile Memorandum. [Deleted.]

The schedule needed to meet these requirements is costly and quite ambitious. [Deleted]. During the FY 1982-FY 1984 time frame, we have improved current reactor efficiency and reliability, converted N Reactor to a weapon-grade production mode, upgraded L Reactor for restart in October 1983, upgraded PUREX for reactivation in FY 1984, and continued the Facilities Restoration program. Also, we will continue to blend high-purity plutonium with supplies of existing fuel-grade plutonium and are preparing to convert the Savannah River reactors to high productivity cores. In addition, we are working on development of the plutonium isotope separation technology and eventually a New Production Reactor for tritium production. A portion of the increase is for slightly enriched uranium for N Reactor and for the high productivity cores which was not included in previous budgets.

A breakdown of the increase by major activity is provided for your information:

	Portion of Increase
Inflation (FY 1982-FY 1984)	17%
N Reactor Conversion to Weapon-Grade Pu Production	7%
PUREX Reactivation	7%
L Reactor Upgrade	10%
Other Initiatives (Mark 15, Blending, Restoration, Special Isotope Separation, and New Production Reactor, etc.)	8%
Enriched Material Requirements	15%
Other Program Requirements (Security, Safety Environmental, Naval Reactor Support, Material Recycle, Facility Maintenance, etc.)	10%
Total FY 1982-FY 1984 Increase	74%

Special Isotope Separation

Question: If adequate funding were provided what is the earliest schedule for establishing an SIS capability and what would the funding requirements be by fiscal year?

Answer: Given early approval of an accelerated funding program, an SIS production plant would be operational [deleted] [deleted] beginning in FY 1988. The full production would be reached during FY 1989. This schedule would require the following funding by fiscal year:

($ in millions)

1984	1985	1986	1987	1988	1989
$100	$230	$210	$170	$100	$90

Question: What is the total cost for construction of an SIS demonstration facility, a pilot plant, and a production facility?

Answer: Based on the current program schedule, each of the two prototype demonstrations, AVLIS and MLIS, will cost approximately $200 million. The total cost of a production facility including the cost of pilot operation is estimated to be about $450 million.

Question: How much feed material is currently available for an SIS process and from what sources, and is there a continuing source of feed material? If there is no continuing source of feed material, how will this production facility be utilized after the feed material is depleted?

Answer: [Deleted.]

Question: Your request for the Special Isotope Separation Research program is being reduced by $19,000,000 in FY 1984 to provide for a longer period of R&D before construction of a demonstration facility. At this level of funding, when would a pilot plant and a production facility be operational?

Answer: The current program schedule and outyear cost projections would allow startup of pilot operations during FY 1989. [Deleted.] The full production plant processing rate would be achieved in FY 1990.

Question: What is the current plan for making a process selection and proceeding from that point? Would both the Lawrence Livermore process and the Los Alamos process be demonstrated on a prototype scale or would this be done only on the selected process?

Answer: The decision as to whether to move ahead with a production facility is being carefully considered by the Secretary of Energy. It is anticipated that this decision, including the process to be used and the production location, will be reached soon so that a substantial part of the FY 1983 funding can be applied toward this objective. At the same time, given the importance of this technology to meeting our materials production requirements, the particular advantages of each process, and the remaining technical uncertainties with both processes, the Department of Energy also intends to continue work on the alternate technology at least through the prototype demonstration stage. This is necessary to provide high assurance of attaining the required material production from Special Isotope Separation.

Question: How much funding is requested in FY 84 for TRW?

Answer: No SIS funds are being requested for the TRW Plasma Separation Process in FY 1984. However, this process shows considerable promise for separations of isotopes other than plutonium, and DOE anticipates that these will be pursued during

FY 1984 as a part of the process research and development work supported by defense programs.

New Production Reactor

Question: How much is included in the FY 84 request for the New Production Reactor and what work will be accomplished?

Answer: Our FY 1984 budget includes $5,000,000 for these activities. The major activities in fiscal year 1984 are: site studies, initial environmental analyses, establishment of program/project planning and management, establishment of safety criteria and preliminary safety analysis report activities.

Site studies will include the detailed studies of characteristics, i.e., geology and hydrology of the specific areas within the selected sites. Environmental and safety analyses cover the implementation of both the environment and safety plans developed in FY 1982 within the funding limits. This includes preparation of the appropriate NEPA documentation.

Program/project planning and management includes the continuing of project planning operations and management activities associated with the New Production Reactor project. Specific activities will be the establishment of safety criteria against which the preliminary safety assessment report will be developed.

Question: What is the total estimated cost of a new production reactor and can you provide more detailed cost estimates on the three priority processes recommended by the Advisory Panel?

Answer: The cost estimates for a new production reactor range from $3 to $6 billion depending upon the site and concept selected. These estimates, though very preliminary, include all the fuel cycle support facilities such as fuel fabrication, lithium target processing facilities, etc., needed to support the particular site and concept combination being considered.

Detailed cost estimates on the three priority processes recommended by the Advisory Panel are not available at this time. These estimates will depend heavily on the site selected because of the variations in the support facilities needed. Detailed design will not begin until concept and site are selected.

DEFENSE NUCLEAR WASTE

Nuclear Waste Act

Question: What impact will the recently passed Civilian Nuclear Waste Act have on the Defense Nuclear Waste program?

Answer: There is no impact on the Defense Nuclear Waste Program as a result of the Nuclear Waste Policy Act of 1982. We will evaluate the need for a defense-only repository as required by that Act by January 1985.

Status Of Waste Isolation Pilot Plant Project

Question: What is the status of the Waste Isolation Pilot Plant construction?

Answer: We have completed the exploratory phase of the WIPP which includes sinking two shafts and extensive mining at the 2150 foot level. We are preparing the report which will assess the suitability of the site for radioactive waste disposal. That report will be available in late March and the State of New Mexico will have two months to review and comment. We have requested an Administrative Land Withdrawal from DOI to allow full construction to proceed in July 1983 as scheduled.

Question: Why has the construction funding for the Waste Isolation Pilot Plant been reduced from $110.8 million in FY 1983 to $59.3 million in FY 1984? Why has a deferral of $50 million been initiated in FY 1983? Have any significant problems developed on the project which are slowing down the pace?

Answer: The Office of Management and Budget was not sufficiently convinced during their review of our FY 1984 budget that all WIPP activities, specifically the validation of the site for demonstrating waste disposal and administrative land withdrawal from the Department of the Interior (DOI), would be ready in time to proceed with construction in July 1983. We are working closely with the State and DOI and expect that the schedule can be maintained. No significant technical problems have been experienced. The job remains on or ahead of schedule. If the schedule is maintained in FY 1983 we anticipate that the OMB will release the deferred 1983 funds. In that case we may request a supplemental in FY 1984 to maintain the WIPP schedule.

Question: How much of the funds are being provided to the State of New Mexico for their participation in the WIPP project?

Answer: Approximately $1 million in FY 1984.

Question: What is the status of the land withdrawal program for WIPP?

Answer: The Administrative Land Withdrawal application was submitted to DOI on January 14, 1983. DOI published a notice of the DOE application in the Federal Register on January 27, 1983, and announced its intention to hold public hearings. These hearings are now scheduled for May 4 in Albuquerque and May 5 in Carlsbad. We believe that a Public Land Order withdrawing the WIPP site can be issued in time for a July 1983 construction start.

Waste Transfer Program

Question: What is the status of the waste transfer program at Richland and Savannah River?

Answer: We are continuing to transfer waste to new double shell tanks at Richland and Savannah River. We expect to complete that activity at Richland in FY 1989 and at Savannah River in FY 1994. The Savannah River program has been stretched out about three years to save costs and to interface more effectively with the DWPF.

Question: What new tanks are still required at Richland and Savannah River?

Answer: Beyond the eight tanks now under construction at Richland, no new tank projects are required for either Savannah River or Richland if DWPF is built as scheduled at Savannah River and N-reactor at Richland is shut down by 1995.

We do have an FY 1983 tank project which requires $31 million in FY 1984 which will provide eight additional tanks to meet existing Richland needs.

Question: How many new tanks are funded to date and are projected to still be required at each site?

Answer: We have funded and built 27 new tanks at Savannah River and 20 at Richland. Eight additional tanks are being built at Richland as discussed previously. We expect to build more calcine bins at Idaho as needed every few years. We have built five and a sixth set is funded and under construction.

Nuclear Waste Definitions

Question: I understand that a series of new definitions have been developed for each class of nuclear waste. Please provide these definitions and please describe what additional approvals are required.

Answer: The Nuclear Waste Policy Act of 1982 (P.L. 97-425) defines high-level waste as the highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and other highly radioactive material that the Commission, consistent with existing law, determines by rule requires permanent isolation.

DOE Order 5820.1, issued in September 1982, defined both transuranic and high-level waste. Transuranic waste is defined, without regard to source or form, as materials that at the end of institutional control periods are contaminated with alpha-emitting radionuclides other than uranium with half-lives greater than 20 years in concentrations greater than 100 nCi/g. High-level waste is defined as the highly radioactive materials that result from the reprocessing of spent nuclear fuel, including, but not limited to, liquid waste produced directly in reprocessing and any solid waste derived from the liquid that contains fission products and transuranic waste as to require permanent isolation.

EPA and NRC have supported the concept of DOE's definition of transuranic waste in letters to us.

EPA and NRC are required by P.L. 97-425 to develop standards for protection of the public from releases of radioactive materials from repositories, and technical requirements and criteria for construction operation and closure of repositories. The Act also says that NRC requirements and criteria shall not be inconsistent with EPA's standards.

We expect that there will be no conflict between our definitions and the NRC and EPA waste definitions developed in accordance with the Act.

Question: What impact will these definitions have on the defense nuclear waste program?

Answer: Some currently designated high-level waste will be redesignated as transuranic waste and some transuranic waste will be redesignated as low-level waste. For example, of the approximately 150 tanks of previously designated high-level waste at Richland, only two-thirds may remain in that category. Approximately one-third of our stored transuranic waste may be redesignated as low-level waste. A detailed evaluation will be necessary before exact inventories changes can be made.

Quantity And Status Of Waste

Question: Please describe the quantity and status of the various classes of nuclear waste at each site.

Answer: Our inventories of high-level, transuranic and low-level waste are indicated on the attached charts. High-level waste is stored in tanks or bins. Transuranic waste generated prior to 1970 is buried, while transuranic waste generated since that date is retrievably stored. Low-level waste is routinely buried.

General Plant Project Funding

Question: Why is it necessary to increase GPP funding from $19.6 million in FY 1983 to $25.8 million in FY 1984?

Answer: The increase is required to upgrade and replace deteriorated and obsolete facilities, primarily at Hanford and Idaho. The funding reflects the planned program growth to restore these sites by 1988. In addition, programmatic increases are required at Savannah River to support increased waste operations.

Byproducts Utilization

Question: Why is byproducts utilization funding being eliminated in FY 1984? What has been accomplished to date? Are there any other areas in byproducts utilization where you feel the Department could make a contribution in the public interest if funds were provided?

Answer: The Administration feels this program should be funded by private industry or other users of the byproducts. We are working with the DOD in demonstrating self-illuminous lighting and secure power supplies. We have demonstrated on a pilot scale the use of cesium for sterilizing sewage sludges. We feel that more could be accomplished, particularly in the areas of food sterilization and in nuclear power supplies for remote defense applications.

Question: Has DOE acted to defer funds provided for the byproduct utilization program?

Answer: No. We expect to fully obligate our FY1983 funds by the end of FY 1983.

Question: What is the status of the DOE commitment to provide assistance to the City of Albuquerque for the byproduct utilization program?

Answer: We have entered into a cooperative agreement with the City of Albuquerque to provide the City with financial support during design and construction of the sludge irradiator. We are renegotiating the cooperative agreement to provide the necessary support with FY 1983 funds to complete design and construction. With no funding in FY 1984, we will complete construction of the irradiator and then will have to leave the City of Albuquerque on its own to handle any problems during the demonstration phase.

Other Questions

Question: Why is the community assistance program being funded in the weapons program in FY 1984?

Answer: Under Section 91 of the Atomic Energy Community Act of 1955, the Department of Energy (DOE) must provide assistance to specified units of local government in the communities associated with the Los Alamos National Laboratory (LANL) and the Oak Ridge complex. The statutory purpose of the assistance is to compensate the Los Alamos and Oak Ridge communities for their lack of an industrial or commercial tax base. As the primary mission of LANL and the Oak Ridge complex is to support the DOE's Defense Programs activities, Defense Programs has a keen interest in maintaining both good relations with local communities and assuring that a healthy and stimulating community environment is maintained to attract top quality technical and administrative personnel.

The transfer of the Community Assistance Program to the DOE's Defense Programs management was done to insure timely and attentive administration of these local communities and their school systems. This ultimately benefits national security defense programs because it is in the best interest of our national security to have the best possible personnel involved in the DOE's defense programs.

Question: What impact does the New Mexico tax case have on the need to continue these payments?

Answer: In regard to the New Mexico tax policy, the State of New Mexico has the option of using the gross receipts tax monies on a statewide basis or prorating the funds to each county. We are not certain as to how the new tax policy in New Mexico will affect the community assistance program, if at all.

Question: Please provide a priority listing based on DOD input of your Phase 3 projects and projects presently in construction.

Answer: Following is a list of weapon system projects and a construction status for each. Projects are not listed in any priority order.

Warhead	Project	Phase 3 Date	Construction Status
W80-1 W80-0	Project 78-16-a, Cruise Missile warhead production facilities	6/79	Construction 30% complete.
W81	Project 83-D-124, Standard Missile-2 (SM-2) warhead production facilities	9/77	Not started.
W82	Project 82-D-109, 155mm AFAP warhead production facilities	2/78	Construction 4% complete. Progress suspended pending resolution of FY 1983 funding needs.
B83	Project 79-7-p, Facilities for modern strategic bomb	2/79	Construction near completion.
W84	Project 80-AE-5, Ground launced cruise missile warhead production facilities	9/78	Construction 50% complete.
W85	Project 80-AE-13, PERSHING II warhead production facilities	5/79	Construction 70% complete.
W87	Project 81-D-115, Missile X warhead production facilities	2/82	Construction 2% complete. Progress suspended pending FY 1983 funding release.
	Project 83-D-134, SENTRY warhead production facilities	a/	Not started.
	Project 84-D-112, TRIDENT II warhead production facilities	b/	Not started.
	Project 84-D-113, Antisubmarine warfare/standoff weapon warhead production facilities	c/	Not started.

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a/ Included in current stockpile memorandum. Anticipated Phase 3 date now under review.
b/ Anticipated Phase 3 date October 1984.
c/ Anticipated Phase 3 date in 1985.

Question: Provide for the record a table detailing the status of each major construction project now underway. Show the project number, description of project, total estimated cost, authorization to date, appropriation to date, 1983 appropriation, 1984 request, obligation to date, commitments to date, percentage of completion, and expected final costs. Please group projects by location.

Answer: The requested information will be provided separately.

Question: Why do you need a new helicopter?

Answer: The major need for this helicopter is in the area of protection against a terrorist attack that could result in the theft of a nuclear device and/or special nuclear material. Additionally, it is required as a quick airborne response command, control, and communication capability against other unauthorized intrusions and incidents. More specifically, the helicopter will provide a quick reaction response to alarms from remote sensors, airborne reconnaissance of and response to emergency situations, pursuit against intruding aircraft, and support for Department of Energy courier shipments passing through the area.

[Deleted].

(Deleted)
the helicopter will be used for other security missions, such as to provide surveillance and an airborne communication capability during other routine operations involving nuclear devices and special nuclear materials. Currently, on an interim basis, an Air Force helicopter is being provided under agreement between the Department of Energy and the United States Air Force for preplanned convoy escort and other scheduled activities. Priority Air Force missions, such as search and rescue, can result in the nonavailability of a helicopter under that arrangement, and the Air Force helicopter cannot be made available on a 24-hour basis. This new helicopter would assure continuous security monitoring coverage versus the current situation where a Department of Energy convoy mission may be without airborne security coverage for all or part of the duration of the convoy movement.

Question: Provide for the record any analysis of the benefits of purchase over leasing or similar arrangements.

Answer: The lease/purchase analysis performed for the helicopter indicates a payback period of about three and one-half years. Estimated useful life of the helicopter is in excess of ten years. Cost factors used in the analysis included $1,000,000 for helicopter purchase, $400,000 for related equipment, and annual incremental operating costs of $500,000. Lease costs, based upon firm quotes from commerical helicopter services, were estimated at between $900,000 and $1,000,000 annually.

The purchase option is preferred based upon the fact that it will limit Government liability should a hostile environment be encountered during the operation of the helicopter. This option will also maximize operations by assuring the availability of dedicated crews with appropriate security clearances and a basic knowledge essential for continuity in operational procedures.

University of Rochester

Question: What is the status of the University of Rochester program, especially the frequency conversion program for the OMEGA laser which will provide the required data for short-wavelength, ultraviolet, interaction experiments?

Answer: The frequency conversion program for the OMEGA laser at the University of Rochester is as follows: 6 beams of the 24-beam system will be converted from infrared to ultraviolet, blue, wavelength by the end of FY 1983. Based on experimental data obtained with 6 blue beams, a decision will be made in FY 1984 whether to convert additional beams to ultraviolet wavelength.

Question: Are the predicted advantages of using short, less than one micron, wavelength lasers being confirmed? What more needs to be done to clearly demonstrate the advantages of short-wavelength light?

Answer: The predicted advantages of using short wavelength lasers are being investigated at this time in an extensive series of experiments on the 15 kilojoule NOVETTE laser at the Lawrence Livermore National Laboratory. The University of Rochester will perform experiments in early FY 1984 with six 0.35 micron blue beams in a spherical geometry. These will be the first experiments to study the effectiveness of short wavelength lasers for targets illuminated in spherical geometry.

Question: Could the conversion program be accelerated? What would be the programmatic advantages of doing so? How much would it cost?

Answer: Before the question of an accelerated conversion program can be addressed, it is necessary to perform experiments with 6 blue beams in spherical geometry to study the overall effectiveness of blue light--versus infrared light--for direct drive. Based on the data obtained in these experiments, if a decision is made to convert the remaining 18 OMEGA beams to the blue, the potential benefits of an accelerated conversion program would be weighed against other important program needs in times of severely limited resources. The cost to convert 18 additional beams to blue light is about $2 million.

Question: What role does the Rochester Program play in the Department of Energy's Inertial Fusion Five-Year Program Plan?

Answer: The University of Rochester plays a significant role in the direct-drive portion of the inertial fusion program. The University program will provide a major element in the development of the data base in the direct-drive portion of the inertial fusion program for the 1987 Program Decision. The University will perform experiments on the OMEGA laser, which is the highest energy direct-drive laser available for spherical geometry experiments. In addition to their contribution in direct-drive, the University of Rochester efforts in target-interaction experiments and theory, optical materials technology, and laser optics support the mainline indirect-drive program at the Lawrence Livermore National Laboratory.

Question: How does the Department of Energy program take advantage of the short-wavelength conversion and optical materials technology developed by Rochester?

Answer: The short-wavelength conversion and optical materials technology developed by the University of Rochester and other Laboratories has been very beneficial to the Department of Energy inertial fusion program. As a result of this technology, short-wavelength laser-target experiments are being performed by several laboratories in the program to investigate the effectiveness of using lasers with sub-micron wavelengths to drive inertial fusion targets.

Question: The University of Rochester has made significant contributions to the inertial fusion program, especially in its fusion physics research; that is, frequency conversion support to the lead laboratory--Livermore. Next year the University's five-year contract draws to a close just as the inertial fusion program appears to approach productive results of years of investment. What are your plans for the extension of the Rochester support contract? For what period of time and at what annual funding level?

Answer: Because of the significant contributions of the University of Rochester to the inertial fusion program, the extension of the University's contract and options to that extension are under study by the Office of Inertial Fusion at this time. This study is taking into consideration the present role of the University in the program in light of a planned FY 1987 decision on the future of the inertial fusion program. A schedule outlining the various steps necessary for renegotiation has been established.

QUESTIONS SUBMITTED BY SENATOR MATTINGLY

L Reactor

Question: Mr. Roser, you are probably aware of the controversy regarding DOE's environmental assessment made in connection with the restart of the L Reactor at the Savannah River Plant. As a result of the public concern expressed at a hearing conducted by Senator Thurmond and me, Secretary Hodel has subsequently agreed to a further public review process. As you no doubt know, documents have now been released that show the Region IV office of the EPA in Atlanta was in favor of a full EIS. While I am glad to see the Department agreeing to the additional review suggested by Senator Thurmond and myself, I do not feel now this will restore public confidence in the L Reactor restart. In that regard, I would like to submit for the record copies of the most recent correspondence between myself and the Secretary. Was DOE aware of the widespread opinion in the Region IV EPA office favoring an EIS?

Answer: On October 15, 1982, officials from the Department of Energy's (DOE's) Savannah River Operations Office met with officials of EPA, Region IV in Atlanta, Georgia to present a summary of the information in the L Reactor Environmental Assessment (EA) and the basis for the Finding of No Significant Impact (FONSI). At that meeting, DOE officials were made aware of the opinions of some EPA staff members that preparation of an EIS for L Reactor would be desirable. In no case, however, did EPA raise any technical issues which were not adequately addressed in the EA. At that time EPA had not yet evaluated the various staff opinions to reach an agency position.

Question: If the Government loses the current lawsuit and is ordered late this summer to begin a full EIS, how long could the restart be delayed?

Answer: Any delay would depend on the specific action of the court; however, the Department anticipates more than a year would be required from the time a decision was made to prepare an EIS to the issuance of the "Record of Decision."

Question: It is difficult for me to see how the Government can win the current lawsuit. The Government's own experts will be called to the stand to testify how they recommended a full EIS. Bearing that in mind, it might be wise for the Department to seek a settlement now. I am under the impression that the plaintiffs might be willing to sit down with the Department and work out an agreement for an expedited environmental review. It might not be all that much more than Secretary Hodel has already agreed to. It certainly would bring quicker results than a full EIS ordered by a court this summer. Are you aware of any such possibility?

Answer: The Department has studied the "expedited EIS" suggested by Representative Butler Derrick. We find that the primary means for expediting the EIS process involves shortening or eliminating the periods required or recommended for public notice, review, hearings, and comments. Since public involvement appears to be one of the prime reasons cited for requesting an EIS for L Reactor, we concluded that an expedited EIS having reduced public involvement would not satisfy this perceived need.

WASTE ISOLATION PILOT PLANT

Senator JOHNSTON. Now, tell me about the problems with the WIPP facility. There are problems?

Mr. ROSER. Actually, we don't have any problems at the moment, Mr. Chairman. I was in the WIPP facility itself a couple of months ago. I went down to my end of the working level. We are currently pursuing an administrative land withdrawal with the Department of the Interior. That is proceeding very well. We expect that that administrative land withdrawal will be perfected by July 1, when we hope to actually start construction of WIPP.

PROPOSED FUNDING REDUCTION

Senator JOHNSTON. Why was the funding just about cut in half on that?

Mr. ROSER. The reason that that funding was cut by the OMB was they did not believe we would be able to have this administrative land withdrawal in time to spend construction funds this year. They have indicated that if we do get the administrative land withdrawal, that they would entertain coming back for sufficient construction funds to keep the program on schedule. We believe that that is actually what will happen.

Senator JOHNSTON. The kind of waste you are going to store in WIPP will not be the big heat producer?

Mr. ROSER. No, it will be transuranic waste, both contact handled and noncontact handled. But it is lower level, a lower heat load than the high-level waste.

Senator JOHNSTON. So it is really not going to prove up very much about geologic storage, is it?

Mr. ROSER. Well, it will prove up the capability of the storing of transuranic waste in geologic storage. We also hope to have a program of experimentation at the WIPP facility. I emphasize experimentation, to take high-level waste and put it in the salt formation and monitor it as long as we can to gather data and we then retrieve it.

Senator JOHNSTON. You mean the high-heat-producing transuranic waste?

Mr. ROSER. No; high-level waste. There is a difference between what we characterize as transuranic and it has to do with the level of radioactivity. High-level waste is what produces the heat. We do not intend to permanently store any of that in the WIPP facility. But we do believe this is an opportunity to get a lot of good data as to how that material would behave in bedded salt, which is what the WIPP facility is in. So we are proceeding on schedule. We will be presenting to the Congress, subsequent to the administrative land withdrawal, a legislative land withdrawal. The administrative withdrawal will permit us to proceed with the construction. But we think for the long term we should have legislative land withdrawal, and we will be submitting legislation, probably to this session of the Congress, to permanently withdraw that for the purposes of the WIPP project.

Senator JOHNSTON. Thank you very much, Mr. Roser.

Mr. Wagner, would you like to comment?

Dr. WAGNER. Mr. Chairman, from the point of view of DOD——

Senator JOHNSTON. Dr. Wagner, excuse me.

Dr. WAGNER. That is quite all right. Actually, let me say that being a mister in the environment I work in is often a better title than doctor. Anybody can get a Ph. D. [Laughter.]

The product that Mr. Roser delivers to DOD is really in two parts. One is the weapons that are built for stockpile and the other is sort of a stockpile of ideas which could be options for the future, for the next decades of weapons. Both of those products are valuable to us. I want to talk about them both a little bit in turn.

STOCKPILE BUILDS

First, the current stockpile and the one that is going to be built during the next few years. This committee, about 6 months ago, asked both Departments for a report on the justification for the stockpile builds. We sent you a report. I was never particularly happy with it. It is a difficult thing to explain in a way that follows in a one, two, three fashion. Let me try to explain the builds and the numbers that we asked DOE for in a somewhat more hypothetical way, but I think it captures the flavor, I intend it to capture the flavor of why we need the numbers we need from you.

Senator JOHNSTON. While you are on the subject, would you address the question that was reported in the news media recently to the effect that most of the tactical nuclear weapons we have deployed in Europe simply cannot be used; the range is too short, it would be too much danger to our own people, and that it is destabilizing, most of those weapons should be removed. I am sure you saw those reports.

Dr. WAGNER. I will do that.

The issue at hand, however, in terms of DOE builds, has to do more with the strategic systems. [Deleted.]

[Deleted.] So, if I may, let me address the strategic systems first.

I have to go back to start about 15 years ago when we began to see that the Soviets had what was really a major program underway to disperse and harden and proliferate the number of what we think of as military targets in the Soviet Union. By military targets, I mean not only missile silos, I mean command and control centers, troop locations, and so forth.

It was a very expensive and clearly a very deliberate program to harden, disperse, and add to the numbers of such targets.

At about that time, and seeing that they were investing in that kind of an activity, we began also to, via a number of means, see a little better into their understanding of this strategic competition that we are in with them.

The upshot of that which matured over a decade ago, perhaps the decade of the seventies, resulted in an appreciation on our part that to deter them we had to threaten what they value. What they value most, we feel, is their military apparatus, the Red Army. By that I mean not just the land-based, but also sea-based. So the Red Army and their mechanism for political control, of which the Red Army is one.

TARGETING

In order to defer them, we felt we should threaten them in both their apparatus for military control and political apparatus. We began to change our targeting structure. That change is resulting, and has resulted actually, in an increase in the number of targets that we feel we must threaten. If one wanted to attack cities, certainly 100 cities destroyed would do the job.

Senator JOHNSTON. Most of that apparatus, or a good deal of it, is in or right adjacent to cities, isn't it?

Dr. WAGNER. No, sir. It is being dispersed and proliferated all over the countryside, moved away from the cities, in a way in which there is clearly some deliberate attempt to hide what they are doing.

The point that I am driving toward is that because of this program and because of their valuing of those targets, we now have to be able to threaten [deleted] targets, not a few hundred.

[Chart deleted.]

Dr. WAGNER. So let me start with the [deleted] targets that we need to threaten and show you a chart. If I may go up there to speak to the chart and to show you a chart that is an oversimplified, but I believe it captures the spirit of the process we go through, an oversimplified way of starting with [deleted] targets and deriving the stockpile numbers that we have. Hypothetical and oversimplified.

The total Soviet targets, military targets, the political targets, [deleted] not a few hundred, let me call that number N. And I moved it down and now I have said we have three legs of our strategic triad: the submarines, the ICBM's, and the aircraft-delivered weapons.

Now, in order for cross-coverage against the possibility that one of those systems might not function, one of those three legs, and simply for prudence, we don't simply divide the number of targets by [deleted] or anything like that. Again, a hypothetical apportionment might be [deleted] the targets for ICBM's, [deleted] for the submarines, and [deleted] for the aircraft weapons. That adds up to more than one deliberately. Let me pick the ICBM's as an example to go down.

The next thing one has to do, if you have to actually deliver [deleted] in ICBM warheads on targets, you have to penetrate Soviet defenses. Now the ICBM's, the Soviets [deleted]. So I might have to multiply the number I have arriving on target by some factor of, let's say [deleted] in order to get the number before I have to penetrate their defenses. Their doctrine is to attack our weapons, so we have to multiply by another factor to take into account the fraction of ours that will survive, the fraction of the ones that start off on alert that will survive. The Minuteman force is becoming quite vulnerable, we believe, and, therefore, perhaps I have to multiply by a factor of [deleted] to get to the number that I have to start off with before we absorb the Soviet attack and before we have to penetrate their defenses.

WEAPON SURVIVABILITY

Senator JOHNSTON. Can you give me a judgment as to the number of SLBM's that would survive today and, say, 1990, and the same judgment with ICBM's?

Dr. WAGNER. I can't give you a very accurate judgment of that. You will see that in the SLBM column I have said that the survivability is very good. I have to multiply by, perhaps, nothing, by perhaps just a factor of [deleted].

Senator JOHNSTON. They will catch some in port, of course.

Dr. WAGNER. That I take in terms of the alert factor down here in this column. If you are well alerted and the force is generated, maybe most everything is at sea. If it is truly an out-of-the-blue attack, maybe they catch [deleted] in port.

But your question specifically asked how many today and how many in 1990, and there isn't a calculation that will result in that. In fact, that is one of the things I want to come through in what I say here is that these aren't arithmetically derived estimates. They are judgment factors. That is why it is hard for us in supporting the DOE budget to write down a coherent rationale which I can get in a few pages. You would really have to immerse yourself in this problem, look at the Soviet ASW technology, look at the U.S. anti-ASW technology, which Admiral McKee manages, and come to what ultimately comes as a technical and military judgment. Then you multiply the number you have to put on target by some conservative factor.

Now because the SLBM's are pretty survivable, I would multiply by a factor that is not [deleted] for survivability, much larger for ICBM's, and someplace in between for the bombers. If there is good alert, perhaps all the bombers would get away. If there is a bad alert, maybe the Soviets would destroy [deleted] of our bombers.

In terms of alert fraction, I addressed the SLBM alert. Virtually all of the ICBM's are in alert, so I don't need to multiply by a factor there. The bombers are perhaps [deleted] on alert, depending on the degree of warning. So if I take all of these factors and multiply them together, I have to take the number that I need to arrive on target, multiply it by some factor between [deleted] for the SLBM's, between [deleted] for the ICBM's, and, because of Soviet air defenses, perhaps a factor of [deleted] for the bombers. So you can see that if the number of targets I start off with is a [deleted].

For bombers, the factor can be very large.

Senator JOHNSTON. I understand this chart. I guess what I am getting at is on ICBM's. Do you know—surely we have a judgment as to percentage. I mean, we know what the target area is. What do you call it?

Dr. WAGNER. The CEP.

Senator JOHNSTON. We know what that is. We ought to be able to put a percentage on that and make some assumptions as to how vulnerable they are.

Dr. WAGNER. That is where I get this factor of [deleted]. Maybe the Soviets with their CEP and the number of warheads they have and their yield could destroy [deleted] of Minuteman, maybe [deleted] of Minuteman.

Senator JOHNSTON. That is today?

Dr. WAGNER. Today. In fact, you will see some estimates that [deleted] percent of Minuteman. I haven't covered the complete, the full width of the range.

Senator JOHNSTON. Do you expect that to—obviously that is going to increase, isn't it?

Dr. WAGNER. That will get worse, yes.

Senator JOHNSTON. Should they ever be able to count on destroying more than, say [deleted] considering it has to go through poles.

Dr. WAGNER. I think that by the late eighties, my personal judgment is the Soviets could count on some number like [deleted] percent.

Senator JOHNSTON. [Deleted] percent by the late eighties?

Dr. WAGNER. Yes, sir, I believe so, against Minuteman. Their accuracy with the new generation that will come in and their yields are certainly adequate to cover that.

Senator JOHNSTON. Trident II is as accurate as any missile in the world, isn't it?

Dr. WAGNER. Today, well, of course, Trident II doesn't exist. It won't go into the stockpile until the late eighties and early nineties. By the late eighties and early nineties our feeling is that the Soviet accuracies and our accuracies will be comparable. There is an uncertainty in the estimates, but I think we feel that within——

Senator JOHNSTON. We are ahead right now?

Dr. WAGNER. Today, I believe again the intelligence estimates are that we are perhaps a little ahead, but not much, with the current generations of systems—not much—and that by the time the Soviets get another generation in, they will have caught up with technology plateauing and will be essentially the same as we are. That, of course, is what poses the danger that during the late eighties there will be a true first-strike capability on their part, especially against the ICBM's.

Senator JOHNSTON. Not especially; solely against the ICBM's. You said "especially." It is not especially against the ICBM's. It is solely against the ICBM's.

Dr. WAGNER. Well, the argument that—the way you describe the Soviet first-strike capability is a direct attack against the ICBM's, an attack against the communications to the submarines, utilizing all of these complicated nuclear effects, EMP, and communications interruptions from the nuclear burst and direct destruction of the communication modes, and a direct attack against the bombers, coupled with this incredible air defense system they have. So that if we did not do the modernization programs that we want to do and some of which are underway, that, in fact, with that kind of an attack they could put together a true first-strike capability.

Now my own view is that it would be difficult for them to do that, to accomplish that attack that I just described. But the consequences if they could do that would be so catastrophic that we ought to spend the money to keep it from being even a remote possibility for them.

Senator JOHNSTON. This weapons program to me doesn't prevent that. I am not giving this as an argument against the weapons enhancement program. But a weak link in it all is command and control.

Dr. WAGNER. We are also hardening the command and control system and improving it. But let me say that the weapons themselves do address the problem. The B–1 will have a faster base escape time so that they will be less likely to be able to destroy the bombers before they get away. It is going to be more able to penetrate the Soviet air defense. In addition, the cruise missiles on the B–52's which may survive will make the remaining B–52's much more effective in terms of penetrating the Soviet air defense.

So the upgrades to the bomber leg of the triad do address the survivability first-strike problem. The MX, of course, is intended—and there is clearly a lot of debate, and justifiably so, on whether the close space basing will solve that. Even if the basing for the MX is no more survivable than Minuteman, the number of surviving MX will still be able to threaten retaliation against the Soviets more than the current Minuteman.

Senator JOHNSTON. I have to go vote. We will take a short recess.

[A brief recess was taken.]

Senator JOHNSTON. Dr. Wagner, you were in the middle of your presentation. Please proceed.

Dr. WAGNER. You had just asked me whether—I have forgotten what your question was [laughter] but my answer was that even if the MX had to be deployed in a mode which was no more survivable than Minuteman, it would still have a better deterrent value because one surviving MX can threaten more retaliation, which is, after all, what the return is about, than a surviving Minuteman. So, frankly, putting some number of MX in Minuteman silos seems to me to be a step in the right direction, not the wrong direction.

Senator JOHNSTON. They are also a more lucrative target.

Dr. WAGNER. It is.

Senator JOHNSTON. Really, I think the value of the land-based ICBM, unless you can find a movable mode, which is very questionable in this country, is that they have to come to your land, to your territory——

Dr. WAGNER. Yes, sir.

Senator JOHNSTON [continuing]. And strike, which we don't want to talk about it on the outside much, but it is a very useful thing. It would be very hard for you to convince me that putting the MX in the existing silos is a smart thing, first because it is more lucrative; second, because you get so little bang for the buck. I mean, if they are [deleted] percent vulnerable and by 1990, was it, you know, how much additional bang do you get. I think you get a greater advantage by putting another submarine or two out there that is going to be invulnerable, although difficult to communicate with. The Soviets can't count on the fact, first, that we can't communicate with them, and second, that they are not going to figure out there is an attack and respond on their own.

Please proceed.

Dr. WAGNER. I think we could talk about ICBM's and what their marginal value is for a long time.

The point that I wanted to make here with this chart—and it is clear to me that you understand the point, although I certainly wouldn't want to put words in your mouth to the effect you agree with it—is that the number is [deleted] as one sometimes hears.

Senator JOHNSTON. Yes.

AGING OF WEAPONS

Dr. WAGNER. Let me show you now the chart that Mr. Roser showed you in a somewhat different form.

[Chart deleted.]

This is the total number of weapons in stockpile since about 1960. You know it went down sharply in the midseventies. So this shows that, in fact, we are going to be [deleted] are captured in the kinds of considerations that I had on the previous chart.

The triangles are the IOC dates of the systems which are currently in today's stockpile. What you can see is that there was, in fact, a hiatus of 5, 6, 7 years during this period. That is the basis for one of the arguments that we are making these days to the effect that there is an obsolescence problem, just a physical obsolescence problem connected with our forces.

Senator JOHNSTON. You are not talking about the tritium decay.

Dr. WAGNER. No, sir, I am talking about the aging of the weapons. The ones I have circled in red are the systems that are in production during fiscal 1983, the current fiscal year. Minuteman III will be, or is perhaps, just about now through with production, as is Lance. We will continue with the Trident I warhead, with the air-launched cruise missiles. The B–83 new strategic bomb to replace, among other things, the B–28's that you asked about earlier, we will start production soon. The ground-launched cruise missile and Pershing II we will start production soon. The 8-inch has been in production for a year and a half or so. And the B–61, it looks like there is an old weapon continuing to be produced, but there have been a number of mods along the way.

Senator JOHNSTON. What percent of our hard-target kill capability is in existence now?

Dr. WAGNER. I don't know the answer to that question.

Senator JOHNSTON. Would you speak to the argument in the press, I think it was this week, to the effect that some of these tactical nuclear weapons are, in effect, unusable?

Dr. WAGNER. Yes. Let me show you—would you like me to put a chart up that shows the tactical weapons?

Senator JOHNSTON. Yes.

WEAPON DEPLOYMENT

Dr. WAGNER. Here are the numbers deployed [deleted] in 1977, today, and 1988.

[Chart deleted.]

These are already in several groups: the nuclear artillery, the first two columns; and then the total nuclear artillery; the short-range missile systems, these three lines; and then this is the total of the short-range missile systems and the nuclear artillery.

Senator JOHNSTON. Is that new deployments or total deployments?

Dr. WAGNER. This is totals. Then there are the two long-range theater systems, the ground-launched cruise missile, and the Pershing, the total of that category; then air-delivered weapons; and then air defense and atomic demolition munitions; with the totals down here at the bottom.

You can see we are coming from about [deleted] in 1977 to [deleted] today to [deleted] in 1988.

Senator JOHNSTON. The range of the 155, if I recall, is about 8 miles.

Dr. WAGNER. Today it is about 8 miles. The new 155, the W-82, will have a range of between [deleted] kilometers, so [deleted] miles.

Senator JOHNSTON. The 8-inch is what?

Dr. WAGNER. The 8-inch is on the order of—again, the old one and the new one are somewhat different. The current 8-inch, as I remember, is about [deleted]. The new one, which is being built today, is about [deleted]. So the ranges are extended.

You can see that, in fact, we are, have been, and will continue to retire some of the most obsolete short-range systems, in particular the Honest John and the Sergeant, whose retirement was earlier than 1977.

Senator JOHNSTON. Those ranges are what?

Dr. WAGNER. Those ranges are again 10, 20 miles, maybe a little longer.

Senator JOHNSTON. But not very accurate.

Dr. WAGNER. Rather inaccurate, and just obsolete in a lot of ways.

The nuclear artillery, we feel, is quite effective for several reasons. It is short range, but the range is by no means so short that you can't use it for fear of hurting your own forces. In fact, it is useful, in a sense, because it is short range, because it is targeted. It is in the control loop, once nuclear release is achieved, it is in the control loop of the forces that are in contact and they can see what is hurting them. So it is not so much its range but the fact it is subordinated to the forces that are in contact. That gives it some value.

The real value in the nuclear artillery is that it is very survivable because there are a lot of cannon, hundreds or thousands of cannon. The Soviet doctrine, [deleted] the Soviet doctrine is they are not going to attack until they can be pretty sure they have destroyed or can destroy our nuclear-capable systems. They devote a lot of training and a lot of resources to that end, not just nuclear resources but conventional. Agents, what we would call special force groups—they call them Spetsnues—there are [deleted] special forces, a large fraction of which would be devoted to going behind the lines against air bases and command centers, but also very deliberately, specifically against our nuclear-capable forces.

Once we can disperse the weapons—and there is a bit of a problem there, but I think it can be done—once we can disperse them, then they have to go after many hundreds of firing batteries with the nuclear artillery as opposed to a few tens of launchers with the missile systems. So the artillery, we think, really gives them pause.

So we intend to retire the old artillery shells, the 155 and 8-inch, and replace them with the new ones which are more effective and long range.

We are retiring the essentially unusable Honest Johns. We are modernizing the Lance and we will keep the Lance out into the late eighties and probably into the nineties.

Senator JOHNSTON. What is the range of the Lance?

VOICE. [Deleted.]

Dr. WAGNER. And it can stand back then and be a little more survivable, even though it is fewer launchers.

Senator JOHNSTON. And that has the enhanced radiation on it.

Dr. WAGNER. The Lance, the version we are currently producing, does have an enhanced radiation warhead.

Pershing and GLCM you are familiar with. The bomb stockpile we are upgrading from, oh, let's say less deliverable bombs to newer bombs. So again, while the number stays essentially constant, [deleted] the quality of that stockpile is going up.

Senator JOHNSTON. GLCM is going to be deployed next year, isn't it?

Dr. WAGNER. Starting in December, and Pershing around the same time.

Mr. WADE. December of this year.

Dr. WAGNER. We are retiring the [deleted]. So we are, in fact, getting rid of the obsolete systems which are less usable. Let me say, though, the rate at which we get rid of them is paced partly by the fact that the [deleted] will take quite some time. So we can't retire things too rapidly.

Senator JOHNSTON. Would you just briefly tell me how survivable are the GLCM's and Pershing. How survivable will they be?

Dr. WAGNER. The GLCM's are probably considerably more survivable than the things we have there today. Once they are warned and disperse off the main operating bases, then they are pretty survivable. There are arguments that go on as to whether the launchers and the convoys that accompany it are obvious and identifiable. But they are certainly more survivable, for instance, than aircraft on main operating bases.

The same with Pershing. Pershing I is pretty survivable today and Pershing II will have other features built in to make it even more survivable. The signature is more reduced. It will be sort of more anonymous when dispersed.

The survivability of all of these weapons is a serious problem, and that is one thing that drives our entire modernization program.

Have I addressed your point about the usability and unusability?

Senator JOHNSTON. Yes, I think so, and I think very well.

Dr. WAGNER. All right. We have talked about the strategic builds. We have talked about the tactical builds. That concludes what I had wanted to say about the production requirements we place on DOE.

ADVANCED CONCEPTS

I would like to spend a few minutes talking about the other part of their product, which is advanced concepts and advanced research, which is the part that is somewhat less visible and it doesn't pay off for a number of years, but we feel makes a real difference and was, to some extent, neglected during the seventies when, as you know, the DOE budget declined.

DOD was ordering weapons during those years, and DOE responded. In order to respond to our request, they had to cut advanced development. They are going to have to catch up in advanced development during the next decade. That is going to take resources, and Mr. Roser described some of the R&D projects that they have.

We think that the reasons for doing those kinds of advanced developments are these. I have written down four reasons.

Basically, what we mean by advanced development is improved features in weapons. I will talk about what some of those features are. It is fairly simple.

We think that that kind of advanced development is paying off in today's weapons that they are producing, that even if we get the kinds of arms control that we will hope we can get by whatever route, there is going to be a continuing need for improvements in the warheads. [Deleted.] So we think that the new features will continue to be necessary.

[Deleted.] We are concerned that they may be doing some very imaginative things, and we want to avoid surprise, so we have to understand what is possible.

Then, finally, and a point that I think I am coming to see more and more strongly all the time, is that the U.S. capability in advanced technology just of itself, almost independent of how it is manifested in particular weapons, creates a sort of deterred state of mind on the part of the Soviets. I would like to talk through this point for just a minute and talk about the features in the weapons.

Senator JOHNSTON. You don't need to sell me on that. I am very much aware of that. If you would like to put that in for the record, that is fine.

Dr. WAGNER. All right. In that case, that concludes what I had really wanted to say about the DOD requirements for DOE programs. So I am happy to answer questions.

Senator JOHNSTON. You already have answered a great deal, Dr. Wagner. I appreciate your testimony. Both of you have been very forthcoming and very good to answer all of those questions of mine.

NAVAL REACTOR DEVELOPMENT PROGRAM

STATEMENT OF ADM. KINNAIRD R. McKEE, DIRECTOR, NAVAL NUCLEAR PROPULSION PROGRAM

PREPARED STATEMENT

Senator JOHNSTON. Finally, we have Admiral McKee.

Admiral, I understand this is your first appearance before this subcommittee. We welcome you.

Admiral McKEE. Thank you, sir. It is good to be here.

I have been in my job about a year now. It has been a busy year for me.

You have a prepared statement from me. I will not try to go through it page by page. Perhaps I could summarize shortly and then respond to questions.

Senator JOHNSTON. Yes, please do. Your full statement will be made part of the record.

[The statement follows:]

STATEMENT OF ADM. KINNAIRD R. MCKEE, DIRECTOR, NAVAL NUCLEAR PROPULSION PROGRAM

This is my first appearance before the Senate Appropriations Committee since I became Director of the Naval Nuclear Propulsion Program last year. I want to thank you for the opportunity to testify and assure you that I remain committed to standards of technical integrity and operational excellence that have been the hallmark of this unique National defense organization.

Last week I returned from the last of three sea trials of new submarines-- the FLORIDA, our third TRIDENT submarine, and the ALBUQUERQUE and NORFOLK, our latest SSN 688 Class attack submarines. These ships will join the fleet later this year, bringing the TRIDENT submarine force to three, with seven more authorized -- and bringing the 688 Class attack submarine force to 23, with 18 more authorized. The Navy's 1984 budget request will add one additional TRIDENT submarine and three attack submarines to that force.

The fourth nuclear powered aircraft carrier, USS CARL VINSON, also joined the fleet last year, and the fifth, THEODORE ROOSEVELT, is under construction at Newport News. Work has also begun on two more aircraft carriers authorized by Congress last year.

Today, these nuclear powered warships represent over 40 percent of the Navy's first line combatants -- 125 submarines and 13 surface ships. These are the most versatile and effective warships of their kind in the world today. They continue to maintain an unprecedented tempo of operations for a nation at peace. Their ability to do that, year in, year out, has been a major factor in our national strategy of forward deployment.

It is particularly important to recognize the contribution of our TRIDENT/POSEIDON force to our strategic deterrent posture. A substantial portion of the U.S. strategic nuclear warheads and the most invulnerable are based at sea. The true value of this major investment can only be measured in the fact that they have remained unused.

The ability to meet our commitments rests on several basic principles that are reflected in the design and construction of these ships, and in the selection and training of men who operate and maintain their nuclear propulsion plants. Over the years, Admiral Rickover testified to the importance of these principles before this and other Congressional committees, and to the need for your continuing support. There is nothing remarkable about the fundamentals that govern the Naval Nuclear Propulsion Program. What is unique -- in our Navy and the world -- is our record of adherence to them.

Nothing has changed. Our record of safe and effective operation continues to depend upon the technical integrity of a small group of dedicated headquarters and field personnel in my organization, and upon the operational skill and dedication of the men who operate these ships daily under difficult, demanding, and, at times, dangerous conditions.

The Naval Nuclear Propulsion Program makes extraordinary demands on these men -- long hours, endless training, qualification, and requalification. It is not enough that they must achieve a singular level of professional competence. They must also prove their competence over and over again; and all this they must do in the face of extended and frequent separations from their families.

To meet our national commitments, our attack submarines average about 50 percent of the time away from port, and our strategic deterrent submarines 65 percent. Our nuclear aircraft carriers (CVNs) operate at a comparable tempo. This is more than twice the comparable Soviet peacetime tempo. Of course, our operating tempo increases substantially in periods of crisis.

It is also useful to view these demands on a broader scale. For example, our submarine officers and enlisted men comprise only about four percent of the Navy, yet the ships they operate contribute over one third of our combatant forces.

Where do we get such men? What makes them stay?

Certainly, there is the challenge of the job, working with competent peers, and the satisfaction of doing important work well. There is also the psychic income that derives from being part of a small, select group of people that enjoys a unique reputation for professional competence. But these factors alone are not enough.

Recognizing this, Congress has supported special pay incentives to help attract and keep the people we need. As a result, our accession and retention trends are improving in some areas. In others, we continue to fall short.

Overall, the trends have become favorable, but the situation is fragile. When trends begin to improve, even a little, there is always the temptation to conclude that no more needs to be done. There lies the irony -- the better our talented people do their jobs, the less apparent the need for these talented people and for incentives commensurate with the demands we place on them. These men remain extremely marketable in today's technologically advanced industrial environment.

Our program now operates 168 nuclear reactors and trains over 3,000 new officers and men each year to man a growing fleet. All this represents a major investment in combat capability. You have the right to ask if it has been worth the price. My unequivocal answer is yes.

Today's force of nuclear powered ships is fast, and heavily armed. They have the range and endurance to carry out their mission anywhere in the world. Tough and flexible, they are built to take punishment and stay on the line.

Our submarines also have special characteristics that are essential to the unique requirements of submarine warfare. Silent and deep diving, they can operate alone and unsupported, even in waters controlled by a potential enemy. Properly handled, they can meet any competition on their own terms.

In the final analysis, these are the most effective warships of their kind in the world today. They are also expensive, but well worth what John Adams once referred to as "the toil, blood, and treasure it will cost ... to defend these states."

That brings us to an item of traditional congressional interest. How are we doing today? Are we ahead or behind?

Today, the honest answer is that, with adequate tactical latitude to retain the initiative, we can prevail at sea. You have given us the tools and individual talent to do that. But what we can do today is not the only issue in this hearing. The budget you are considering must do more than provide for maintenance of our present capability. It must also provide assurance of a favorable balance in the years to come. To do that requires a full understanding of the trends on both sides.

We are good at what we do, and well equipped to carry out our mission. But the Soviets are good too, and getting better. They have introduced five new classes of submarines in the last seven years. They seem to be getting ready to build their first CVN, an obvious indication of their growing interest in projecting power away from their shores.

They have not only built a blue water Navy to contest our maritime supremacy anywhere in the world; they have also developed the infrastructure needed to support a major continuing effort to maintain favorable trends in both the quality and the quantity of major warships.

The result is clear evidence of a continuing Soviet commitment to maritime excellence. That commitment can be seen in their ability to graduate at least 10 times as many naval architects and marine engineers per year as we do, and in their development of a submarine building capacity at lease twice ours. More important, they use that capacity to build at a faster rate than we do.

It is also clear that they fully recognize both the deterrent value and combat potential of a large and effective submarine force. Recent events of the South Atlantic campaign again confirmed these principles as a handful of British submarines controlled the surface of ocean areas surrounding the Islands. The same conflict also proved again the importance of controlling the airspace over a naval theater of operations. We cannot afford to assume that the same lessons went unnoticed by Soviet naval commanders.

We must depend on continuing quality and adequate numbers to make up for their improving sophistication and numerical superiority. However, favorable margins in the parameters by which we measure our ability to control tactical and strategic engagements are steadily decreasing in the face of recent Soviet improvements. I would still rather command a LOS ANGELES class submarine than any of today's Soviet counterparts, but I am concerned over the current trend of Soviet advances. We cannot afford to stand by while our advantage erodes. It is time to start on a new design SSN.

Secretary Weinberger, in his testimony on the FY 1984 budget submission, emphasized the importance of developing a new design attack submarine that will "capture the latest advances in technology." We have the ability to do this, and I strongly recommend Congressional support of this effort.

The FY 1984 budget does not contain that specific new start, but it does provide for the R&D efforts needed to bring us to the point of initial authorization later in this decade. We must get on with it.

Let me return to the subject of people. In the final analysis, the ability to maintain our record of safe and effective operation can only be preserved if we can continue in the standards of selection, training, qualification of people in every facet of our program, civilian and military, and can meet our retention goals across the board. Congressional support has been instrumental in our success thus far, but this subject will continue to require your special attention.

The Naval Reactors portion of the Department of Energy's FY 1984 budget request includes $490 million in operating requirements, $20 million in capital equipment needs, and $103 million to continue construction work. The work is directed at improving reactor performance - increasing power and extending lifetime. It includes diverse efforts such as: testing the TRIDENT plant and an advanced reactor for use in existing ships; developing the Submarine Test Core to determine the utility of new materials; constructing a facility to provide a second source for naval fuel; and developing the Advanced Fleet Reactor. The total request comes to $613 million. I have attached a detailed description.

We are well along on the Water Cooled Breeder Program -- aimed at demonstrating our ability to achieve breeding in existing light water reactors. Last October the Shippingport Atomic Power Station was shut down for the last time after successfully operating with a light water breeder reactor supplying electric power to a commercial power distribution system for more than five years.

The original lifetime objective for the core was 15,000 effective full power hours of operation. The core actually operated more than 28,700 effective full power hours.

End-of-life tests on the reactor have been completed and core removal, which will take about two years, is underway. After core removal, the spent fuel modules will be sent to the Expended Core Facility in Idaho for evaluation and disposal.

The core evaluation work is to confirm the light water breeder core performed as predicted and to evaluate the effects of the high burnup rates achieved on the reactor fuel and materials. Light water breeder technology is a way to take advantage of our ample thorium reserves -- a potential energy source sufficient to meet our demands for hundreds of years.

The budget request for the Water Cooled Breeder program for FY 1984 is $35.5 milion -- $9 million less than the FY 1983 budget. Of this amount, $33 million is to complete the core removal effort at Shippingport and receive the spent fuel modules in Idaho. The remaining funds are for core evaluation. I have attached a detailed discussion of my budget request.

The light water breeder reactor concept offers an alternate energy source based on pressurized water reactor technology proven in many years of operation. The core evaluation work is necessary to realize the return on our investment in light water breeder development.

The Water Cooled Breeder program is projected to be completed by the end of FY 1987 with all the findings and conclusions documented and disseminated to industry.

FY 1984 DEPARTMENT OF ENERGY BUDGET REQUEST FOR THE NAVAL REACTORS DEVELOPMENT PROGRAM

The Naval Reactors Development program provides for the design, development, testing, and evaluation of improved naval nuclear propulsion plants and reactor cores having long fuel life, high reliability, improved performance, and simplified operating and maintenance requirements. The nuclear propulsion plants and cores cover a wide range of configurations and power ratings to meet warship requirements ranging in size from small submarines to large surface ships.

Major development efforts underway in the Naval Reactors Development program include: an Advanced Fleet Reactor which will take advantage of new fuel element concepts and reactor equipment technology to provide improved performance and increased endurance; a Submarine Test Core, designed to test advanced reactor materials at the pressure, temperature, and power conditions of an operating reactor plant environment; work on the TRIDENT submarine propulsion plant, including test and evaluation of the plants in the land-based prototype and the USS OHIO; and the higher power, longer life D2W core for shipboard application. Ongoing development efforts include: advanced fuel processing and manufacturing techniques; materials development research aimed at improving reactor plant performance and endurance; continued operation of eight prototype reactor plants for research and development and training purposes; improvement, evaluation, and technical support of existing nuclear propulsion plants, components, systems and cores; and development of replacement components and systems.

The FY 1984 Naval Reactors Development budget request is $613.0 million. The details of the request, by category, are:

		BA (in millions)
Plant Development		
Operating Expenses		$ 59.0
Reactor Development		
Operating Expenses	$188.8	
Capital Equipment	20.0	
Construction	103.0	
Subtotal		$311.8
Reactor Operation and Evaluation		
Operating Expenses		$112.0
Enriched Material*		
Operating Expenses		$120.0
Program Direction		
Operating Expenses		$ 10.2
TOTAL NAVAL REACTORS DEVELOPMENT		$613.0

*Funding for Enriched Material was included in the Uranium Enrichment budget in FY 1982 and prior years and the Materials Production budget for FY 1983.

The FY 1984 budget request of $613 million provides for a continuation of current programs. The increase of $86.1 million over FY 1983 is primarily due to escalation, development of the Advanced Fleet Reactor, servicing and refueling of prototype reactor plants, construction of the Materials Facility, and increased Navy need for enriched uranium.

A discussion by budget category follows:

I. PLANT DEVELOPMENT

The Plant Development effort is aimed primarily at improving plant reliability and performance. This includes developing improved reactor and steam plant components and systems, and developing alternate plant materials, new heat treatment methods and new chemistry treatment and water purification methods.

Component and system development work starts with reactor plant arrangement studies based on operational requirements and continues through design, testing, and operational support of installed equipment. In addition to performance and reliability, noise reduction and shock resistance are particularly important. This work involves developing sophisticated mathematical models with which to predict performance in simulated plant operation and to evaluate actual component performance at a later date. Full scale mock-ups are used to verify installation suitability and maintenance capabilities of components and systems prior to manufacture and testing of components.

The interaction between various materials and water chemistries is important to the performance and reliability of nuclear propulsion plant systems. Alternate material and chemistry candidates are subjected to extensive testing and evaluation. The most promising are then pursued under prototypal conditions and environments to verify material performance characteristics prior to qualifying them for application in reactors. This program includes development of new techniques for testing and analyzing materials, water chemistry performance, heat treatment, corrosion, mechanical properties, and failures.

In FY 1984, Naval Reactors will continue Plant Development efforts including: develop materials leading to improved component performance; conduct plant analysis for backfit of an advanced reactor in the CGN 36 and 38 Class cruisers; continue preparation of procedures for future refuelings of SSN 688 Class ships; develop simpler and less costly methods for cleaning steam generators; and develop advanced design reactor equipment for application to naval nuclear propulsion plants.

II. REACTOR DEVELOPMENT

The Reactor Development effort focuses on improving the power capabilities, endurance, and reliability of naval reactors ranging from relatively small submarine reactors to the large ones used in nuclear powered aircraft carriers. The objective is to design and develop improved reactors based on the latest reactor concepts, technology, and experience.

Reactor fuel and poison elements are very important in developing reactor cores of increased endurance and power. These must be able to accommodate the higher fuel and poison loadings, and sustain the irradiation damage that is inherent with higher power densities and longer operating lives of reactor cores. To ensure high integrity over the long lifetimes of present cores requires care and attention in establishing the configurations of advanced fuel and poison elements. These highly loaded cores also require development of advanced control rod materials and control concepts. Optimizing the performance, life, and power of reactor cores in the hostile environment in which they operate demands sound and careful engineering and powerful analytic tools to predict the long term reactivity behavior and material response in various core concepts.

The development effort includes the fabrication of prototype cores and components for installation, operation, and testing in prototype reactor plants under operating conditions. This includes developing sophisticated processes and inspection techniques to ensure quality during manufacture of these advanced cores. Data from examination of expended cores constitute important feedback as to the long term behavior of these cores from the standpoint of nuclear characteristics, materials, and performance.

During FY 1984 Reactor Development work will include: fabrication of Advanced Fleet Reactor equipment; performing physics and design studies for the Advanced Fleet Reactor; developing the nuclear, thermal/hydraulic, and mechanical design of the Advanced Fleet Reactor; completing fuel assembly development for the Submarine Test Core; performing physics analysis of Submarine Test Core fuel modules; and work on the Developmental Fuel Core.

Additional work in this area will include: examining expended cores to evaluate core performance; assessing new technologies for advanced fuel and poison elements; performing thermal, hydraulic, and mechanical tests of core components; developing design concepts for advanced reactors; and developing processing technologies for naval fuels.

Capital Equipment

Capital equipment requirements for Fiscal Year 1984 include computer-aided drafting equipment for the laboratories as well as other laboratory support equipment. This equipment is necessary for the laboratories' continued development of advanced technology and for the continued safe operation of the prototype reactor plants.

Construction

Construction funds are requested in Fiscal Year 1984 for the Modifications and Additions to Prototype Facilities (MAPF), project number 81-T-112, the Materials Facility, project number 82-N-111, and the Addition to the Radioactive Materials Laboratory, project number 83-N-102.

The MAPF project provides for modifying and adding to the engineered safety features of several prototype plants. The work primarily involves upgrading the emergency fluid and electrical systems, and includes construction of necessary equipment and support buildings. The prototype plants involved are the D1G and S3G plants at West Milton, New York, and the S1C plant located in Windsor, Connecticut.

Funds for the Materials Facility at Savannah River, South Carolina, are to continue construction of a second source for manufacture of naval nuclear fuel. Initial funds were provided in Fiscal Year 1982 and work is presently underway. The Department of Energy is currently dependent on only one supplier for the naval nuclear fuel upon which over 40 percent of the Navy's combatant ships depend. This leaves the Naval Nuclear Propulsion Program vulnerable to the risk of prolonged disruption in fuel supplies because of strikes, operational shutdowns, natural catastrophes, or other unanticipated problems. The added capacity provided by this project will also allow flexibility to accomodate an expanded shipbuilding program.

In addition, funds are requested to complete the design and construction of a shielded facility to be located in an extension of the Radioactive Materials Laboratory at the Knolls Atomic Power Laboratory. The new shielded facility will provide needed additional testing and examination capacity for Naval Reactors' efforts in analyzing advanced fuel systems currently under development as well as continued evaluation of existing fuel systems.

III. REACTOR OPERATION AND EVALUATION

Reactor Operation and Evaluation involves the operation of land based prototype nuclear propulsion plants and their related servicing and evaluation. These prototypes are operated to test developmental nuclear propulsion plants, cores, and components. While accelerated testing and special test facilities are valuable aids in simulating behavior of various components and materials, there is no substitute for the actual in-service experience obtained from the operation of the prototype plants. Only through actual operation is it possible to determine performance, confirm designs, and test various plant conditions under operating circumstances and without interfering with fleet operations. The prototype reactors and components are fully instrumented to provide test data needed to support developmental programs. The prototype plants provide an ideal test bed for new concepts, materials, and designs while gaining operational experience in advance of reactors in the fleet.

Work in this area also includes developing reactor servicing procedures and equipment as well as actual reactor servicing. Servicing work includes: maintenance, refuelings, disassembly, fuel exchange and reassembly operations on reactors, examination of installed reactor components, and removal of reactor components for examination. Equipment and procedures developed for prototype operations are used to the maximum extent possible in preparing for the servicing and refueling of shipboard reactors.

Work in the Reactor Operation and Evaluation area in FY 1984 will include: performing thermal/hydraulic analyses for operation of prototype reactors; preparing for and following performance of prototype plant refuelings; providing technical assessments of plant operating conditions; modifying facilities; performing overhaul and maintenance effort; preparing for the S5G and S1W prototype plant refueling/overhauls; conducting the D1G interim inspection; completing the S1C refueling/overhaul; and preparing procedures for S3G, MARF, and S8G refueling/overhauls.

IV. ENRICHED MATERIAL

The Enriched Material portion of the Naval Reactors Develoment budget provides for enriching the uranium used in manufacturing reactor cores required for the nuclear powered ships of the U.S. Navy. The enrichment work is carried out by the DOE Office of Uranium Enrichment. This work is essential to the National defense.

The amount of enriched uranium purchased each year is determined by the needs of the Navy. The planned number of ship refuelings, tempo of fleet operations, number of ships under construction, and other schedular requirements dictate the number of cores to be fabricated for the Navy in a given year. This figure in turn determines the amount of enriched uranium needed by the core manufacturers in that year. The required enrichment services are then obtained from the Office of Uranium Enrichment.

Funding for Enriched Material was included in the Uranium Enrichment program for FY 1982 and prior years, and in the Materials Production program in FY 1983.

V. PROGRAM DIRECTION

The program direction funds provide for salaries, benefits, travel, and other expenses for 207 full time Federal employees at the Naval Reactors, Pittsburgh Naval Reactors, and Schenectady Naval Reactors Offices in support of the Naval Reactors Development and Water Cooled Breeder programs.

Naval Reactors operates with austere staffing. Existing personnel are used to the greatest extent practicable in staffing new efforts and expansions of existing programs. Improvements in work force productivity have been achieved over the years, despite increasing workloads, by effective use of available staff.

FY 1984 DEPARTMENT OF ENERGY BUDGET REQUEST FOR THE WATER COOLED BREEDER PROGRAM

The Water Cooled Breeder program's mission is to develop technology for significantly improving the efficiency of nuclear fuel resource utilization by water cooled nuclear reactors used for electrical power generation. The concept being evaluated is a self-sustaining breeder reactor, cooled and moderated with ordinary (light) water and fueled with uranium-233 and thorium.

Successful confirmation of breeding in the Shippingport light water breeder core will provide the basic technology to use the nation's thorium reserves for power production. Thorium is much more abundant than known fossil fuel reserves. The light water breeder concept is the only known approach using proven light water reactor technology for increasing fuel utilization efficiency significantly beyond the approximately one percent achievable with present types of light water thermal reactors.

The FY 1984 Water Cooled Breeder budget request is $35.5 million. The details of the budget request, by category are:

	Budget Authority (in millions)
Operating Expenses	
Defueling Activities	$33.0
Core Evaluation	2.5
TOTAL, Water Cooled Breeder	$35.5

A discussion by category follows:

I. Defueling Activities

In October 1982, the Shippingport plant ceased routine operation with the Light Water Breeder core and end-of-life testing and reactor defueling began. The Shippingport defueling effort will take approximately two years, ending in FY 1984. The overall defueling activities will continue until completion of fuel shipments from the Expended Core Facility to the Idaho Chemical Processing Plant in 1987.

Efforts associated with the defueling process in FY 1984 include: maintaining the Shippingport plant and providing instrumentation, control, and electrical power system operational support for the light water breeder core removal; completing head area disassembly, fuel removal and shipment, and equipment disposal; disassembling fuel modules for shipment; continuing ongoing training of personnel at the Expended Core Facility (ECF) in Idaho to receive and handle the spent fuel; continuing preparation of procedures and installation of equipment; receiving the spent fuel modules at ECF; unloading the shipping containers in the water pits, and transferring the fuel to water pit storage receptables. Other defueling efforts will include: providing radiation analysis for component disposal and disposing of removed core components; shipping a spare fuel module and fuel rods to the Idaho Chemical Processing Plant for storage; and preparing the Shippingport plant for turnover to the DOE Office of Waste Management upon completion of the defueling and shipment of the spent fuel.

Assessment and disposal of components removed from the Shippingport reactor vessel prior to installing the light water breeder core will continue. This includes shipment of the lower core barrel from the previous core.

II. Core Evaluation

A detailed core evaluation at the Expended Core Facility is necessary to determine the condition of the core and the extent of breeding. Core evaluation is expected to take five years.

During FY 1984, work will include: assessing end-of-life test data; publishing technical reports documenting the Shippingport Light Water Breeder Reactor performance; preparing for examination and proof-of-breeding work; and conducting work necessary to provide fuel rods for destructive analysis. Destructive analysis work is funded under the DOE Fuel Cycle Program.

BIOGRAPHICAL SKETCH

ADMIRAL KINNAIRD R. McKEE, U. S. NAVY

Admiral Kinnaird R. McKee was born in Louisville, Kentucky, on 14 August 1929 and was graduated from the United States Naval Academy in 1951. He served in the Pacific fleet destroyer MARSHALL during the Korean War and in eight submarines of the Atlantic fleet since that time. After completion of submarine training in 1953, he served in PICUDA, SEA CAT, and MARLIN. Admiral McKee was ordered to command of USS X-1, an experimental small submarine, in 1956. In 1958, he was graduated from nuclear power training and joined the commissioning crew of SKIPJACK, the Navy's first high performance nuclear attack submarine. Assignment as Executive Officer of NAUTILUS followed in 1961, then SAM HOUSTON in late 1962. After three deterrent patrols in HOUSTON, he served in the Naval Reactors Division of the Atomic Energy Commission from 1964 to 1966.

Admiral McKee served as commanding officer of the nuclear attack submarine DACE from 1966 through 1969. The ship was awarded the Navy Unit Commendation twice during that period. Following command of DACE, Admiral McKee served in the office of the Director, Navy Program Planning, where his responsibilities included strategic warfare, research and development, and submarine and antisubmarine warfare systems. In 1970, he was assigned to the immediate staff of the Chief of Naval Operations, where he established the CNO Executive Panel.

As Commander, Submarine Group EIGHT, Admiral McKee served as the NATO and U.S. Submarine Commander in the Mediterranean from 1973 to 1975. He became the 48th Superintendent of the U.S. Naval Academy on 1 August 1975. Promoted to three-star rank in March 1978, Admiral McKee served as Commander THIRD Fleet with Headquarters in Pearl Harbor from September 1978 to October 1979. He was then assigned as Director of Naval Warfare in the Office of the Chief of Naval Operations where he developed and implemented a new organization charged with planning responsibility for all of the principal Naval warfare tasks.

On 1 February 1982, he relieved Admiral H. G. Rickover as Director, Naval Nuclear Propulsion Program and in March of 1982, he was confirmed by the U. S. Senate for promotion to four-star rank.

Admiral McKee's decorations include the Distinguished Service Medal, the Legion of Merit with four Gold Stars, and three awards of the Navy Unit Commendation. He is married to the former Betty Ann Harris of Montgomery, Alabama. They have two children; a daughter, Anne Arnold, and a son, James Henry III. His parents, Mr. and Mrs. J. H. McKee, reside in Jackson, Mississippi.

OCCUPATIONAL RADIATION EXPOSURE FROM U.S. NAVAL NUCLEAR PROPULSION PLANTS AND THEIR SUPPORT FACILITIES

REPORT NT-83-2—FEBRUARY 1983

SUMMARY

Radiation exposures to Navy and civilian personnel monitored for radiation associated with U.S. Naval nuclear propulsion plants are summarized in this report. Navy personnel manned sixteen tenders, three submarine bases, 124 nuclear-powered submarines and thirteen nuclear-powered surface ships which were in operation at the end of 1982. Eight shipyards were engaged in construction, overhaul and refueling of these ships. The benefits of nuclear propulsion in our most capable combatant ships have long been recognized, and our nuclear-powered ballistic missile submarines form the most invulnerable element of the United States strategic deterrence.

Figure 1 shows that the total radiation exposure in 1982 is about one-fifth of the amount in the peak year of 1966, even though the number of nuclear-powered ships has more than doubled and the number of ships in overhaul has tripled since then. Total man-rem in this figure is the sum of the annual exposures of each person monitored for radiation.

No civilian or military personnel in the Naval Nuclear Propulsion Program have ever exceeded the Federal limit which allows five rem exposure for each year of age beyond age eighteen. Since 1967 no person has exceeded the Federal limit which allows up to three rem per quarter year, nor in this period has anyone exceeded the Navy's self-imposed limit of 5 rem per year for radiation associated with Naval nuclear propulsion plants.

No civilian or military personnel in the Naval Nuclear Propulsion Program have ever received more than one tenth the Federal annual occupational exposure limit from internal radiation exposure caused by radioactivity associated with Naval nuclear propulsion plants.

The average occupational exposure of each person monitored has been about one quarter rem per year. The total lifetime exposure from radiation associated with Naval nuclear propulsion plants to date for all personnel monitored since 1954 has averaged about one rem per person.

According to the standard methods for estimating risk, the risk to the group of personnel occupationally exposed to radiation associated with Naval nuclear propulsion plants is less than the risk these same personnel have from exposure to natural background radiation or to medical radiation. This risk is small compared to the risks accepted in normal industrial activities, and it is small compared to the risks regularly accepted in daily life outside work.

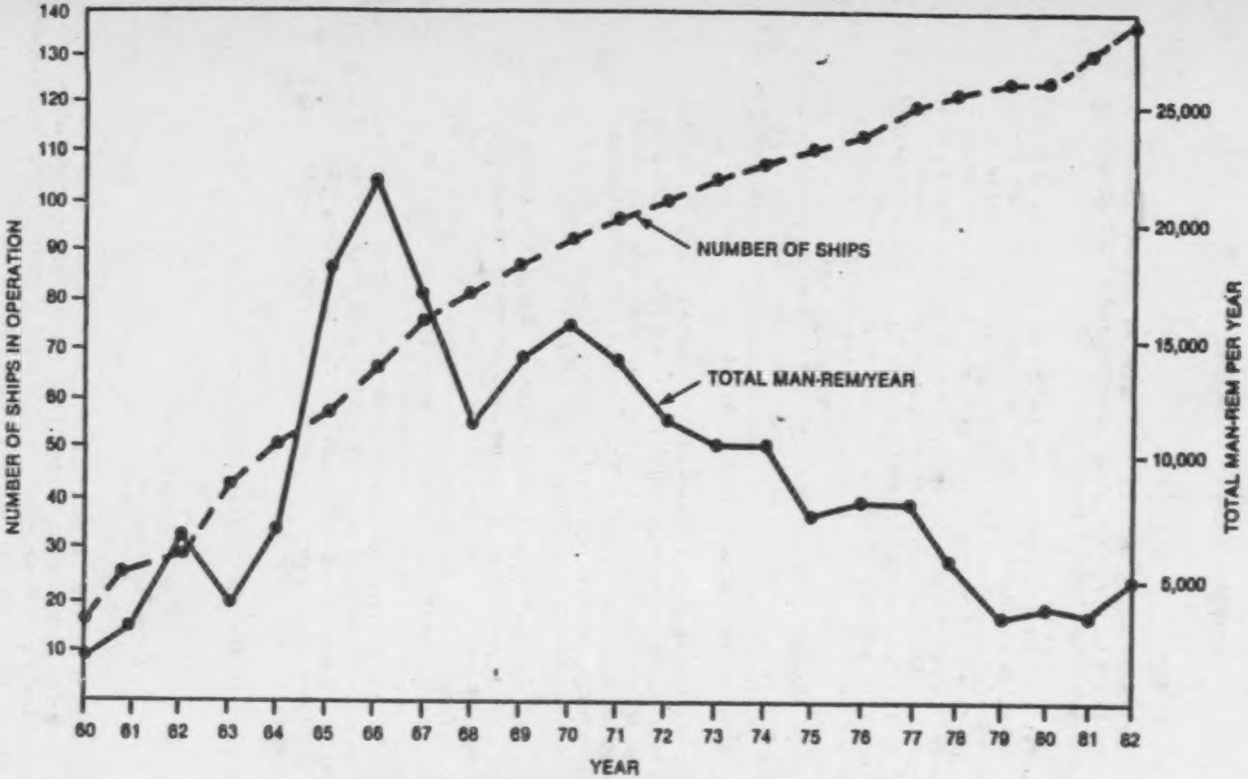

FIGURE 1

TOTAL RADIATION EXPOSURE RECEIVED BY MILITARY AND CIVILIAN PERSONNEL IN THE NAVAL NUCLEAR PROPULSION PROGRAM 1960-1982

EXTERNAL RADIATION EXPOSURE

Policy and Limits

The policy of the U. S. Navy is to reduce as low as reasonably achievable, exposure to personnel from ionizing radiation associated with Naval nuclear propulsion plants.

The radiation exposure limits used in the U. S. and abroad for whole body radiation exposure are 3 rem per quarter year and 5 rem accumulated dose for each year beyond age eighteen. These limits were recommended in 1958 by the U. S. National Committee ("Committee" was changed to "Council" when the organization was chartered by the U. S. Congress in 1964) on Radiation Protection and Measurements (ref 1) and by the International Commission on Radiological Protection (ref 2). They were adopted by the U. S. Atomic Energy Commission (AEC) and applied both within the AEC and to licensees in 1959 (ref 3). The U. S. Federal Radiation Council recommendation that these be used as guidance for Federal agencies was approved by President Eisenhower May 13, 1960 (ref 4). The U. S. Department of Labor adopted these same limits. A key part of each of these standards has been emphasis on minimizing radiation exposure to personnel.

In 1965 the International Commission on Radiological Protection (ref 5) reiterated the quarterly and accumulated limits cited above but suggested that exceeding 5 rem in one year should be infrequent. Although none of the other organizations referred to above changed its recommendations accordingly, the Naval Nuclear Propulsion Program adopted 5 rem per year as a rigorous limit effective in 1967.

In 1971 the National Council on Radiation Protection and Measurements (ref 6) recommended that 5 rem be adopted as the annual limit under most conditions. In 1974 the Atomic Energy Commission (now Department of Energy) (ref 7) established 5 rem as its annual limit. In 1977 the International Commission on Radiological Protection (ref 8) deleted the accumulated limit and recommended 5 rem as the annual limit. In 1979 the Nuclear Regulatory Commission issued a proposed change to the Code of Federal Regulations Title 10, Part 20 to require its licensees to use 5 rem as an annual limit. In January 1981, the Environmental Protection Agency recommended that Federal agencies use 5 rem as an annual limit (ref 9).

The Navy limits for the nuclear propulsion program since 1967 have been:

3 rem per quarter year
5 rem per year

Special limits are in effect such as for hands and feet; however, there have been few cases where these limits have been more restrictive than the whole body radiation exposure limits. Therefore, the radiation exposures discussed in this report are nearly all from whole body radiation. Controls are also in effect to minimize any occupational radiation exposure to the unborn child of a pregnant worker.

Each organization in the Navy Nuclear Propulsion Program is required to have an active program to reduce radiation exposure to the minimum practicable.

Source of Radiation

The radiation discussed in this report originates from pressurized water reactors. Water circulates through a closed piping system to transfer heat from the reactor core to a secondary steam system isolated from the reactor cooling water. Trace amounts of corrosion and wear products are carried by reactor coolant from reactor plant metal surfaces. Some of these corrosion and wear products are deposited on the reactor core and become radioactive from exposure to neutrons. Reactor coolant carries some of these radioactive products through the piping systems where a portion of the radioactivity is removed by a purification system. Most of the remaining radionuclides transported from the reactor core deposit in the piping systems.

The reactor core is installed in a heavy-walled pressure vessel within a primary shield. This shield limits radiation exposure from the gammas and neutrons produced when the reactor is at power. Reactor plant piping systems are installed primarily inside a reactor compartment which is surrounded by a secondary shield. Access to the reactor compartment is permitted only after the reactor is shut down. Most radiation exposure to personnel comes from inspection, maintenance and repair inside the reactor compartment. The major source of this radiation is cobalt 60 deposited inside the piping systems. Cobalt 60 emits two high energy gammas and a low energy beta for every radioactive decay. Its half-life is 5.3 years.

Neutrons produced when reactor fuel fissions are shielded by both primary and secondary shields before penetrating to occupied areas. Radiation exposure to personnel from these neutrons during reactor operation has been much less than from gammas. After reactor shutdown, when shipyard and other support facility work is done, no neutron exposure is detectable. As a result, the radiation exposures discussed in this report are nearly all from gamma radiation.

Control of Radiation During Reactor Plant Operation

Reactor plant shielding is designed to minimize radiation exposure to personnel. Shield design criteria establishing radiation levels in various parts of each nuclear-powered ship are personally approved by the Director of the Naval Nuclear Propulsion Program.

Ship design is also controlled to keep locations, such as duty stations where personnel need to spend time, as far as practicable away from the reactor compartment shield. Special attention is paid to living quarters. For example, the shield design criteria were established such that a person would have to spend more than 48 hours per day in living quarters to exceed exposure limits (which is impossible since there are only 24 hours in a day).

Resulting radiation exposure to those aboard ship outside propulsion plant spaces during reactor plant operation is not any greater than natural background radiation. For submarine operating personnel outside the propulsion plant, the combination of low natural radioactivity in ship construction materials and reduced cosmic radiation under water provides less radiation exposure from the nuclear reactor at sea than the public receives ashore. Those who operate the nuclear propulsion plant receive more radiation exposure in port during maintenance and overhaul periods than they receive from operating the propulsion plant at sea.

Control of Radiation in Support Facilities

Tenders for nuclear-powered submarines and surface ships are designed so that radioactive material is handled only in specially designed and shielded nuclear support facilities. Submarine bases and shipyards limit to the minimum, the number of places where radioactive material is allowed. Specific traffic routes are required to be used for any movement of radioactive material outside these nuclear support facilities. A radioactive material accountability system is used to ensure no radioactive material is lost or misplaced in a location where personnel could unknowingly be exposed. Regular inventories are required for every item in the radioactive material accountability system. Radioactive material is tagged with yellow and magenta tags bearing the standard radiation symbol and the measured radiation level. Radioactive material removed from a reactor plant is required to be placed in yellow plastic, and the use of yellow plastic is reserved solely for radioactive material. All personnal assigned to a tender, submarine base or shipyard are trained to recognize that yellow plastic identifies radioactive material and to initiate immediate action if radioactive material is discovered out of place.

Access to radiation areas is controlled by radiological control personnel. Personnel are required to wear dosimetry devices to enter these areas. Dosimetry devices are also posted outside these areas to verify that personnel outside these areas do not require monitoring. Frequent radiation surveys are required using instruments which are checked before use and calibrated regularly. Areas where radiation levels are greater than 0.1 rem per hour are called high radiation areas and are locked or guarded.

Dosimetry

Thermoluminescent dosimeters (TLDs) are the dosimetry devices worn by personnel to measure their exposure to gamma radiation. The thermoluminescent dosimeter contains two chips of calcium fluoride with added manganese. It is characteristic of thermoluminescent material that radiation causes internal changes which make the material, when subsequently heated, give off an amount of light directly proportional to the radiation dose. In order to make it convenient to handle, these chips of calcium fluoride are in contact with a metallic heating strip with heater wires extending through the ends of a surrounding glass envelope. The glass bulb is protected by a plastic case designed to permit the proper response to gammas of various energies. Gammas of such low energy that they will not penetrate the plastic case constitute less than a few percent of the total gamma radiation present. To read the radiation exposure, a trained operator removes the glass bulb and places it in a TLD reader so that the metal heater wires contact an electrical circuit. An electronically controlled device heats the calcium fluoride chips to several hundred degrees centigrade in a timed cycle, and the intensity of light emitted is measured and converted to a digital readout in units of rem. The heating cycle also anneals the calcium fluoride chips so that the dosimeter is zeroed and ready for subsequent use. The entire cycle of reading a TLD described here takes about thirty seconds. This rapid readout capability was one reason for changing from film badges to TLD's. The use of TLD's permits more frequent measurement of a worker's radiation exposure than film badges. TLD's are required to be processed at least daily in Naval shipyards. Aboard ship TLD's are required to be processed at least monthly except that daily processing is required for anyone entering a reactor compartment or high radiation area.

To ensure accuracy of the TLD system, several periodic calibration and accuracy checks are performed. For example, TLD's are checked when new and once every six months thereafter for accurate response to a known radiation exposure. Those that fail are discarded or repaired. TLD readers are calibrated once each year to verify accuracy by one of several calibration facilities having precision radiation sources and precision TLD standards. In addition, weekly, daily and hourly checks of proper TLD reader operation and accuracy are performed when readers are in use utilizing internal electronic standards built into each reader. In addition to these calibrations and checks, the Navy has an independent dosimetry quality assurance program to monitor the accuracy of TLD's and TLD readers in use at program activities. Precision TLD's are pre-exposed to exact values of radiation by the National Bureau of Standards and provided to program activities for reading. The activity's results are then compared to the actual exposures. Simultaneously, a random sample of dosimeters in use at the activity being tested is selected and sent to a Navy shore facility for accuracy testing. To assure objectivity, the activity being tested is not told of the radiation values to which the precision dosimeters have been exposed and is not permitted to participate in the selection of the dosimeter sample. Any inaccuracies found by these tests that exceed established permissible error bands result in appropriate corrective action such as recalibration of a failed TLD reader. The results of this program demonstrate that the radiation to which personnel are exposed is being measured by the TLD system with an average error of less than 10%.

Pocket ionization chambers with an eyepiece permit the wearer to read his own radiation exposure. This pocket dosimeter is required in addition to a TLD when entering a reactor compartment or a high radiation area. Pocket dosimeters are used to enable the wearer to keep track of his own radiation exposure during a work period. The official record of radiation exposure is obtained from the TLD.

Dosimetry devices are worn on the trunk of the body, normally at the waist or chest, whichever will receive the higher exposure. In some special situations dosimeters are worn at other locations, for example on the hands or fingers or head.

Prior to 1974, film badges were used to measure radiation exposure. Film packets like those used for dental X-ray were placed in holders designed to allow differentiating between types of radiation. The darkness of the processed film was measured with a densitometer and converted to units of radiation exposure. When the first personnel radiation exposures were measured in the Naval Nuclear Propulsion Program there already was widespread photodosimetry experience in the Navy and precise procedures existed to provide reproducible results.

Each film badge was clearly marked with a name or number corresponding to the individual to whom it was assigned. This number was periodically checked by a radiological control technician before a worker entered a high radiation area. In high radiation areas every worker also wore a pocket dosimeter which was read by radiological control personnel when the worker left the area. At the end of each month when the film badges were processed, the film badge measurements were compared with the sum of the pocket dosimeters readings. The film badge results were, with few exceptions, entered in the permanent personnel radiation exposure records.

Discrepancies between film badge and pocket dosimeter measurements were investigated. These investigations included making independent estimates of the worker's exposure using such methods as time spent in the specific radiation area and comparing the estimates with the two measurements to determine which measurement was in error. If the error could not be determined, then the higher exposure was recorded for the worker. In nearly all cases this was the film badge measurement.

Results of numerous tests conducted by shipyards under the same conditions that most radiation exposure was received showed that film measurements averaged fifteen percent higher than actual radiation exposures. This was a conscious conservatism to ensure that under the worst case, the film measurement was not less than the actual radiation exposure. Film response varies with the energy of the gamma radiation. The calibration of the film was performed at high energy where the film has the least response to radiation exposure. Radiation of lower energies corresponding to scattered radiation from shielded cobalt 60 causes the film to indicate more radiation exposure than is present.

Data gathered in over 20 years of neutron monitoring aboard ships using neutron film badges demonstrated that the monitored individuals did not receive neutron exposure above the minimum detection level for neutron film. Naval nuclear-powered ships and their support facilities now use lithium fluoride TLD's to monitor neutron exposure of the few personnel exposed to neutron sources such as for radiation instrument calibration and for reactor plant instrumentation. These measured neutron exposures have been added to gamma exposures in the total whole body radiation exposure in this report, but because neutron exposures are so low, the radiation exposures in this report are nearly all from gamma radiation.

Monitoring for beta radiation is not normally required because betas cannot penetrate the metal boundaries of the reactor coolant system. Beta radiation needs to be considered in maintenance or repair operations only when systems are opened so that personnel are close to surfaces which have been contaminated with radioactive corrosion products from reactor coolant. In these cases normal clothing or eyeglasses or plastic contamination control materials completely shield beta radiation of the energies normally present. Support facilities routinely provide such shielding to eliminate personnel radiation exposure from betas.

Monitoring for alpha radiation is not a normal part of operation or maintenance of Naval nuclear propulsion plants. However, alpha monitoring is sometimes necessary to identify radium daughter products naturally present in the atmosphere.

Physical Examinations

Radiation medical examinations have been required since the beginning of the Naval Nuclear Propulsion Program for personnel exposed to radiation. In these examinations the doctor pays special attention to any condition which might indicate that radiation exposure would cause an increased degree of risk. Passing this examination is a prerequisite for obtaining the dosimetry badge which permits entry to areas where radiation exposure can be received. For military personnel who have already been screened by physical examinations, few fail this radiation medical examination. For civilian shipyard workers, the failure rate is a few percent. However, failure of this examination does not mean a shipyard worker will not have a job. Since shipyard workers spend most of their time on nonradioactive work, inability to qualify for radioactive work does not restrict their job opportunities. No shipyard worker in the Naval Nuclear Propulsion Program has been fired for inability to pass a radiation medical examination.

Radiation medical examinations are given prior to initial radiation work, periodically thereafter (at least every three years), and at termination of radiation work in the nuclear propulsion program (or at termination of employment).

A radiation medical examination includes review of medical history to determine, among other subjects, past radiation exposure, history of cancer, history of radiation therapy, and family history of cancer. In the medical examination particular attention is paid to evidence of cancer as well as cataracts in the eyes. Laboratory procedures include urinalysis, blood analysis, and comparison of blood constituents to a specific set of standards. Chest X-rays with full size film to reduce radiation exposure were also a routine part of all radiation medical examinations until 1977. At that time routine chest X-rays were discontinued, further reducing radiation exposure of workers. Chest X-rays are now performed when clinically indicated at the discretion of the medical officer. In the event disqualifying conditions are found in an examination of Naval civilian or military personnel, the individual is barred from receiving occupational radiation exposure and the results of the examination are reviewed by the Naval Medical Command Radiation Effects Advisory Board. Only after approval of the board would the individual be permitted to receive occupational radiation exposure.

Shipyard, Tender, and Submarine Base Training:

Periodic radiological control training is performed to ensure each person understands the general and specific radiological aspects which he might encounter, understands his responsibility to the Navy and the public for safe handling of radioactive materials, understands the risks associated with radiation exposure and understands his responsibility to minimize his own radiation exposure. Training is also provided on the biological risk of radiation exposure to the unborn child. Prior to being authorized to perform radiation work, an employee is required to complete satisfactorily a radiological control training course, including a written examination. Typical course lengths for workers range from 16 to 32 hours. In written examinations on radiological controls, short answer questions, such as multiple choice and true-false questions, are not normally used. Following are the minimum training requirements for workers:

1. Radiation Exposure Control

   a. State the limits for whole body penetrating radiation. Explain that the rem is a unit of biological dose from radiation.

   b. Explain how "stay times" are used.

   c. Be aware of the seriousness of violating instructions on radiation warning signs and unauthorized passage through barriers; be aware of penalties for violating these requirements.

   d. Discuss procedures and methods for minimizing exposure such as working at a distance from a source, reducing time in a radiation area, and shielding.

   e. Discuss potential sources of radiation associated with work performed by the individual's trade.

   f. State where dosimetry equipment shall be placed on an individual's body.

   g. Demonstrate ability to read all types of dosimeters in use.

   h. Discuss importance of the individual keeping track of his own exposure.

   i. Be aware of the significance of personnel radiation exposure. The National Council on Radiation Protection and Measurements has stated that while exposures of workers and the general population should be kept to the lowest practicable level at all times, the presently permitted exposures represent a level of risk small compared with other hazards of life. The Nuclear Regulatory Commission has stated, "Control of exposure to radiation is based on the assumption that any exposure, no matter how small, involves some risk." The risk of injury from radiation associated with Naval nuclear propulsion plants is low compared to the occupational and nonoccupational risks accepted in everyday life.

2. Contamination Control

   a. Discuss how contamination is controlled during radioactive work (e.g., containment in plastic bags and use of contamination containment areas).

b. Discuss procedures for preventing contamination of personnel and how contamination is detected on personnel.

c. Discuss how contamination is removed from contaminated objects and personnel.

d. Discuss potential sources of contamination associated with work performed by the individual's trade.

e. State the beta-gamma surface contamination limit. Discuss the meaning of the units of the limit.

f. Demonstrate proper procedure for donning and removing a full set of anticontamination clothing.

g. Demonstrate proper procedures for entering and leaving a contaminated area including proper procedures for self-monitoring.

h. Explain what radioactive contamination is. Explain the difference between radiation and radioactive contamination.

i. For personnel required to work in containment areas (e.g., glove bags or tents), demonstrate proper procedures for working in these areas. (This ability is often demonstrated on a mock-up.)

j. For personnel who are likely to encounter airborne radioactivity, demonstrate the proper procedure for donning and removing the type of respiratory equipment the individual will be required to wear. For personnel who are required to wear respiratory equipment with anticontamination clothing, this demonstration shall be performed when donning and removing anticontamination clothing. The demonstration shall include any leak checks required to be made to test for proper operation of respiratory equipment.

k. For personnel who are likely to encounter airborne radioactivity, state the conditions which require wearing masks, air supplied respirators, or air supplied hoods.

3. Accountability of Radioactive Materials - Know that radioactive materials are accounted for when transferred between radiologically controlled areas by tagging, by recording disposition of material, and by specific authorization of radiological control personnel.

4. Waste Disposal - Discuss how individual workers can reduce the amount of radioactive liquid and solid waste.

5. Radiological Incidents

a. Discuss the need for consulting radiological control personnel when questions or incidents occur.

b. Discuss procedures to be followed after a spill of material (liquid or solid) which is or might be radioactive.

c. Discuss procedures to be followed when notified that airborne radioactivity is above the limit.

d. Demonstrate the action to be taken in event of a spill of radioactive liquid. This ability shall be demonstrated during a drill.

e. Discuss the action to be taken when an individual discovers his dosimeter is off-scale.

6. Responsibilities of Individuals - Discuss actions required in order to fulfill workers' responsibilities. Include the responsibility of the individual to inform his employer of previous or concurrent occupational radiation exposure received.

In addition to passing a written examination, completion of this training course requires satisfactory performance during basic types of simulated work operations. For an employee to continue as a radiation worker, he has to requalify in a manner similar to the initial qualification at least every two years. In between these qualification periods, personnel are required to be selected at random for additional examination to determine how well the knowledge has been retained. Training is also conducted by individual shop instructors in the specific job skills for radiation work within each trade. For complex jobs this is followed by special training for the specific job, frequently using mock-ups outside radiation areas.

Radiological control technicians are required to complete a course of six months to one year in length in radiological controls, to demonstrate their practical abilities, and to pass comprehensive written and oral examinations. Radiological control supervisors are required to have at least the same technical knowledge and abilities as the technicians; however, passing scores for supervisors' examinations are higher or supervisors' examinations are more difficult than for technicians. Oral examinations are conducted by senior radiological control managers and require personnel to be able to evaluate symptoms of unusual radiological control situations. The radiological control technician or supervisor is required to evaluate initial symptoms, state immediate corrective action required, state what additional measurements are required, and do a final analysis of the measurements to identify the specific problem. Subsequent to qualification, periodic training sessions are required in which each radiological control technician and supervisor demonstrates ability to handle situations such as are used in the oral examinations. At least every two years, radiological control personnel have to requalify through written and oral examinations similar to those used for initial qualification. Radiological control technicians and supervisors are required to demonstrate their practical abilities frequently through unannounced drills.

In addition to the above training for those who are involved in radioactive work, each shipyard employee not involved in radioactive work and each person assigned to a nuclear-powered ship or a support facility is required to receive basic radiological training which is repeated at least annually. This training is to ensure personnel understand the posting of radiation areas, the identification of radioactive materials, and not to cross radiation barriers. This instruction also explains that the radiation environment of personnel outside radiation areas and outside the ship or shipyard is not significantly affected by nuclear propulsion plant work.

Nuclear Power Training

Military personnel who operate Naval nuclear propulsion plants are required to pass a six month basic training course at nuclear power school and a six month qualification course at a land-based prototype of a shipboard reactor plant. Each nuclear-trained officer and enlisted man receives extensive radiological control training including lectures, demonstrations, practical work, radiological control drills and written and oral examinations. This training has emphasized the ability to apply basic information on radiation and radioactivity.

Those enlisted personnel who will have additional responsibilities for radiological control are designated Engineering Laboratory Technicians and receive an additional three months training after completion of the one year program.

Prior to becoming qualified as the Engineer Officer, that is, the head of the engineering department of a nuclear-powered ship, a nuclear-trained officer must pass a one day written examination and a sequence of oral examinations conducted at Naval Reactors headquarters. A key part of these qualification examinations is radiological controls.

Immediately before serving as Commanding Officer of a nuclear-powered ship, an officer attends a three month course at Naval Reactors headquarters. The radiological controls portion of this is an advanced course and assumes the officer starts with detailed familiarity with shipboard radiological controls. The officer must pass both written and oral examinations in radiological controls during this course prior to assuming command of a nuclear-powered ship.

Radiation Exposure Reduction

Maintaining personnel radiation exposures as low as reasonably achievable involves all levels of management in nuclear-powered ships and their support facilities. Operations, maintenance and repair personnel are required to be involved in this subject; it is not left solely to radiological control personnel. To evaluate the effectiveness of radiation exposure reduction programs, managers use a set of goals. Goals are also set in advance to keep each worker's exposure under certain levels and to minimize the number of workers involved. Goals are also set on the total cumulative personnel radiation exposure (man-rem) for each major job, for the entire overhaul or maintenance period, and for the whole year. These goals are deliberately made hard to meet in order to encourage personnel to improve performance.

Of the various goals used, the most effective in reducing personnel radiation exposure has been the use of radiation control levels which are lower than the Navy's quarterly and annual limits. Control levels in shipyards range from 0.5 rem to 2 rem for the year, depending on the amount of radioactive work scheduled, whereas 5 rem per year is the annual Navy limit.

To achieve the benefits of lower control levels in reducing total man-rem, it is essential to minimize the number of workers permitted to receive radiation exposure. Otherwise the control levels could be met merely by adding more workers. Organizations are required to conduct periodic reviews to ensure the number of workers is the minimum for the work that has to be performed.

Following is a brief checklist which has been in use for years in maintaining personnel radiation exposure as low as reasonably achievable during maintenance, overhaul, and repair.

Preliminary Planning

- Plan in advance
- Delete unnecessary work
- Determine expected radiation levels

Preparation of Work Procedures

- Plan access to and exit from work area
- Provide for service lines (air, welding, ventilation, etc.)
- Provide communication (sometimes includes closed-circuit television)
- Remove sources of radiation
- Plan for installation of temporary shielding
- Decontaminate
- Work in lowest radiation levels
- Perform as much work as practicable outside radiation areas
- State requirements for standard tools
- Consider special tools
- Include inspection requirements (these identify steps where radiological control personnel must sign prior to work proceeding)
- Minimize discomfort of workers
- Estimate man-rem

Temporary Shielding

- Control installation and removal by written procedure
- Inspect after installation
- Conduct periodic radiation surveys
- Minimize damage caused by heavy lead temporary shielding
- Balance radiation exposure received in installation against exposure to be saved by installation
- Shield travel routes
- Shield components with abnormally high radiation levels early in the maintenance period
- Shield position worker occupies
- Perform directional surveys to improve design of shielding by locating sources of radiation
- Use mock-up to plan temporary shielding design and installation

Rehearsing and Briefing

- Rehearse
- Use mock-up duplicating working conditions
- Use photographs
- Brief workers

Performing Work

- Post radiation levels
- Keep excess personnel out of radiation areas
- Minimize beta radiation exposure (anticontamination clothing effectively shields cobalt 60 betas)
- Supervisors and workers keep track of radiation exposure
- Workers assist in radiation and radioactivity measurements
- Delegate radiological control monitoring responsibilities when necessary to minimize radiation exposure
- Evaluate use of fewer workers
- Reevaluate reducing radiation exposures

Additional measures that have been taken to reduce exposure include standardization of procedures, development of new tooling, improved use of temporary shielding, and compliance with strict contamination control measures. For example, most work involving radioactive contamination is performed in total containment. This practice minimizes the potential for spreading contamination and thus reduces work disruptions, simplifies working conditions and minimizes the cost and exposure to clean up.

Lessons learned during radioactive work and new ways to reduce exposure developed at one organization are made available for use by other organizations in the Naval Nuclear Propulsion Program. This effort allows all of the organizations to take advantage of the experience and developments at one organization and minimizes redundant effort.

The extensive efforts that have been taken to reduce exposure in the Naval Nuclear Propulsion Program have also had unplanned benefits, such as reduced cost to perform radioactive work and improved reliability. Efforts such as detailed work planning, rehearsing, total containment, special tools and standardization have resulted in increased efficiency, better access to perform maintenance with the overall result that reliability is improved and costs are reduced.

Radiation Exposure Data

Radioactive materials had been handled in shipyards for years before Naval nuclear propulsion plant work started. Examples of such work include non-destructive testing using radiography sources and radiation instrument calibration using radioactive sources. Since this work is licensed by the Nuclear Regulatory Commission or by a state under agreement with the Nuclear Regulatory Commission, the radiation exposure from this licensed work has been excluded whenever practicable from this report.

Table 1 shows the dates when radioactive work associated with Naval nuclear propulsion plants started in each of eleven shipyards. Seven of these shipyards have constructed Naval nuclear-powered ships; however, little radiation exposure is received in new construction. The dates of starting reactor plant overhaul, therefore, are the significant dates for start of radioactive work.

Table 2 summarizes radiation exposure received in nuclear-powered ships and their supporting tenders and submarine bases since the first nuclear-powered ship went to sea in January 1955. Most of the radiation exposure in this table results from inspection, maintenance and repair work in the reactor compartments of ships. Radiation exposures for reactor compartment work increase as reactor plant radiation levels increase with the age of the plant.

As expected, the number of personnel monitored for exposure to radiation increased with the increasing number of nuclear-powered ships. Initially everyone aboard a nuclear-powered submarine was monitored for occupational radiation exposure. After years of experience showed that personnel outside propulsion plant spaces received exposures indistinguishable from natural background, the number of personnel monitored for occupational exposure to radiation from the propulsion plant was sharply reduced in 1974. For example, in 1973 almost sixty percent of those monitored were recorded as receiving zero radiation exposure; as a result of reducing numbers of personnel monitored unnecessarily, less than twenty percent are now recorded with zero exposure. Personnel outside propulsion plant spaces in submarines now wear dosimetry badges to verify they receive no occupational exposure from the propulsion plant.

Table 3 summarizes radiation exposures of shipyard personnel since the start of Naval nuclear propulsion plant radioactive work in 1954. Figure 2 shows graphically that total personnel radiation exposure has been reduced in shipyards even though the amount of work has increased. Since ship overhauls frequently overlapped calendar years, the numbers of ships in overhaul shown in Figure 2 were determined by dividing by 12 the total number of months each ship was in overhaul during a calendar year.

The increase in the numbers of personnel monitored and total man-rem exposure in the early years shows the increasing workload in reactor plant work as the number of ships increased. By 1962 four submarine reactor plants had been overhauled and major efforts were underway to reduce radiation levels. By 1966 the number of ships in overhaul had quadrupled as indicated by the buildup to the peak in total man-rem. Subsequently, the number of ships in overhaul more than doubled again. Decreases in total annual exposures, numbers of personnel monitored, and numbers of personnel with annual exposures over 2 rem have been as a result of the program to reduce radiation exposures to the minimum practicable. The total annual exposure for the shipyards has averaged less than 6000 man-rem and for ships has averaged less than 2000 man-rem.

Since a worker usually is exposed to radiation in more than one year, the total number of personnel monitored cannot be obtained by adding the annual numbers. The total number of shipyard personnel monitored for radiation exposure associated with the Naval Nuclear Propulsion Program has been about 122,000. Nearly all of these are civilians, almost half of whom are U. S. Government employees at six Naval shipyards. Table 4 provides further information about the distribution of their radiation exposures. In 1982 about 90 percent of those monitored for radiation in shipyards and about 99 percent of those in ships received less than 0.5 rem in a year, the limit allowed by Federal regulations for a member of the general public. The average exposure per year for each person monitored has been 0.32 rem in shipyards, which is less than one tenth the occupational exposure limit. The average exposure per year for those monitored in ships has been 0.12 rem, which is less than the average annual exposure a person receives from natural background and medical radiation.

Table 4 also lists the numbers of personnel who have exceeded the 3 rem quarterly exposure limit. In no case have personnel exceeded the accumulated limit of 5 rem for each year of age over eighteen. The total number of persons who have exceeded the quarterly limit since the limit was imposed in 1959 is 37, of whom 4 were military personnel aboard ships. Thirty of the 37 personnel had quarterly exposures in the range of 3 to 4 rem, and the highest exposure was 9.7 rem in a quarter. Navy procedures require any person who receives greater than 25 rem in a short time period to be placed under medical observation. None of the exposures reached this level.

The average lifetime accumulated exposure from radiation associated with Naval nuclear plants for all shipyard personnel is 1.3 rem. Since the average annual exposure per person is 0.32 rem, this means that the average shipyard radiation worker is monitored because of Naval nuclear propulsion plant work for about four years. The average lifetime accumulated exposure for the 54,000 Naval officers and enlisted men trained to operate a nuclear propulsion plant is about 1 rem. These radiation exposures are much less than the exposure the average American receives from medical diagnostic X-rays during his working lifetime.

Table 5 provides information on the distribution of lifetime accumulated exposure for personnel assigned to tenders, bases and nuclear-powered ships. Typical lifetime exposures of shipyard personnel were discussed in ref (10). Table 5 includes all personnel who at some time in 1982 were monitored for radiation exposure associated with Naval nuclear propulsion plants. Federal radiation exposure limits allow accumulating 100 rem in twenty years of work, or 200 rem in forty years. The fact that no one shown in Table 5 comes close to having accumulated this much radiation exposure is the result of deliberate efforts to keep well below the lifetime accumulated radiation exposure limit.

TABLE 1

SHIPYARD FIRST REACTOR PLANT OPERATION AND FIRST RADIOACTIVE OVERHAUL WORK

Shipyard	Year First New Construction Reactor Started Operation	Year First Reactor Plant Overhaul Started
Electric Boat Division* Groton, Connecticut	1954	1957
Portsmouth Naval Shipyard Portsmouth, New Hampshire	1958	1959
Mare Island Naval Shipyard** Vallejo, California	1958	1962
Pearl Harbor Naval Shipyard Pearl Harbor, Hawaii	None	1962
Charleston Naval Shipyard** Charleston, South Carolina	None	1963
Newport News Shipbuilding and Dry Dock Company Newport News, Virginia	1960	1964
Bethlehem Steel Shipbuilding*** (Subsequently Electric Boat Division) Quincy, Massachusetts	1961	None
New York Shipbuilding Corporation*** Camden, New Jersey	1963	None
Norfolk Naval Shipyard Portsmouth, Virginia	None	1965
Puget Sound Naval Shipyard** Bremerton, Washington	None	1967
Ingalls Shipbuilding Division*** Pascagoula, Mississippi	1961	1970

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* Electric Boat Division performed overhauls in 1957-1977 but only did new construction work again starting in 1978.

** Radioactive work of less extent than in an overhaul commenced in Mare Island in 1958, in Charleston in 1961, and in Puget Sound in 1965.

*** Work on Naval nuclear-powered ships was discontinued at Camden, New Jersey in 1967, at Quincy, Massachusetts in 1969, and at Pascagoula, Mississippi in 1980.

TABLE 2

OCCUPATIONAL RADIATION EXPOSURE RECEIVED BY PERSONNEL ASSIGNED TO TENDERS, BASES, AND NUCLEAR-POWERED SHIPS FROM OPERATION AND MAINTENANCE OF NAVAL NUCLEAR PROPULSION PLANTS

	Number of Persons Monitored Who Received Exposures In The Following Ranges of Rem for the Year						Total Personnel Monitored	Total Man-Rem
Year	0-1	1-2	2-3	3-4	4-5	≥5*		
1954	36	0	0	0	0	0	36	8
1955	90	11	0	0	0	0	101	25
1956	108	10	4	0	0	0	122	50
1957	293	7	1	0	0	0	301	60
1958	562	11	3	0	0	0	576	100
1959	1057	41	8	3	0	0	1109	200
1960	2607	88	8	4	3	1	2711	375
1961	4812	106	31	4	4	0	4957	680
1962	6788	182	75	31	17	1	7094	1312
1963	9188	197	39	14	3	1	9442	1420
1964	10317	331	93	35	15	4	10795	1964
1965	11883	592	224	96	30	24	12849	3421
1966	18118	541	156	95	44	28	18982	3529
1967	21028	339	139	48	11	0	21565	3084
1968	24200	373	103	20	2	0	24698	2463
1969	26969	577	127	39	6	0	27718	2918
1970	26206	610	134	30	0	0	26980	3089
1971	26090	568	122	31	2	0	26813	3261
1972	33312	602	180	13	1	0	34108	3271
1973	30852	600	102	15	1	0	31570	3160
1974	18375	307	65	2	0	0	18749	2142
1975	17638	330	28	1	0	0	17997	2217
1976	17795	369	56	9	0	0	18229	2642
1977	20236	346	95	36	3	0	20716	2812
1978	22089	290	23	1	0	0	22403	2234
1979	21121	75	1	0	0	0	21197	1528
1980	21767	78	0	0	0	0	21845	1494
1981	23781	27	0	0	0	0	23808	1415
1982	27016	59	0	0	0	0	27075	1650

Note: Data obtained from summaries rather than directly from original medical records. However, it is expected that the large effort to compile comparable data from original medical records would show differences no greater than five percent. Total man-rem was determined by adding actual exposures for each individual during the year.

* Limit in the Naval Nuclear Propulsion Program was changed to 5 rem per year in 1967

TABLE 3
OCCUPATIONAL RADIATION EXPOSURE RECEIVED BY SHIPYARD PERSONNEL FROM WORK ASSOCIATED WITH NAVAL NUCLEAR PROPULSION PLANTS

	Number of Persons Monitored Who Received Exposure In The Following Ranges of Rem For The Year						Total Personnel Monitored	Total Man-Rem
Year	0-1	1-2	2-3	3-4	4-5	>5*		
1954	508	9	3	5	3	0	528	64
1955	2563	80	25	6	3	2	2679	344
1956	2834	20	5	2	0	1	2862	162
1957	3473	97	31	1	2	4	3608	495
1958	5766	165	46	10	4	7	5998	779
1959	10388	221	133	78	49	23	10892	1864
1960	12047	198	97	22	4	0	12368	1158
1961	13383	198	91	44	14	3	13733	1241
1962	14411	642	366	247	146	108	15920	5222
1963	19164	446	159	71	34	28	19902	2725
1964	24044	804	445	215	144	41	25693	5678
1965	22630	2306	1314	814	618	525	28207	15829
1966	29490	2352	1623	1057	1139	513	36174	18804
1967	29853	2388	1563	1096	733	1	35634	13908
1968	30159	1344	773	496	279	0	33051	8719
1969	25672	1790	1080	753	375	0	29670	11077
1970	21182	2127	1382	740	492	0	25923	13084
1971	20041	1928	1066	650	240	0	23925	10616
1972	17514	1692	849	139	5	0	20199	7002
1973	13036	1403	604	203	6	0	15252	6083
1974	12587	1464	745	311	50	0	15157	7206
1975	12825	1116	598	82	42	0	14663	5285
1976	13042	1268	633	30	0	0	14973	5310
1977	13835	1277	586	25	0	0	15723	5199
1978	13700	1016	268	0	0	0	14984	3680
1979	15032	227	7	0	0	0	15266	2024
1980	15287	377	0	0	0	0	15664	2402
1981	17414	304	0	0	0	0	17718	2310
1982	19210	648	0	0	0	0	19858	3353

NOTE: Data obtained from summaries rather than directly from original medical records.. However, it is expected that the large effort to compile comparable data from original medical records would show differences no greater than five percent. Total man-rem was determined by adding actual exposures for each individual during the year.

*Limit in the Naval Nuclear Propulsion Program was changed to 5 rem per year in 1967.

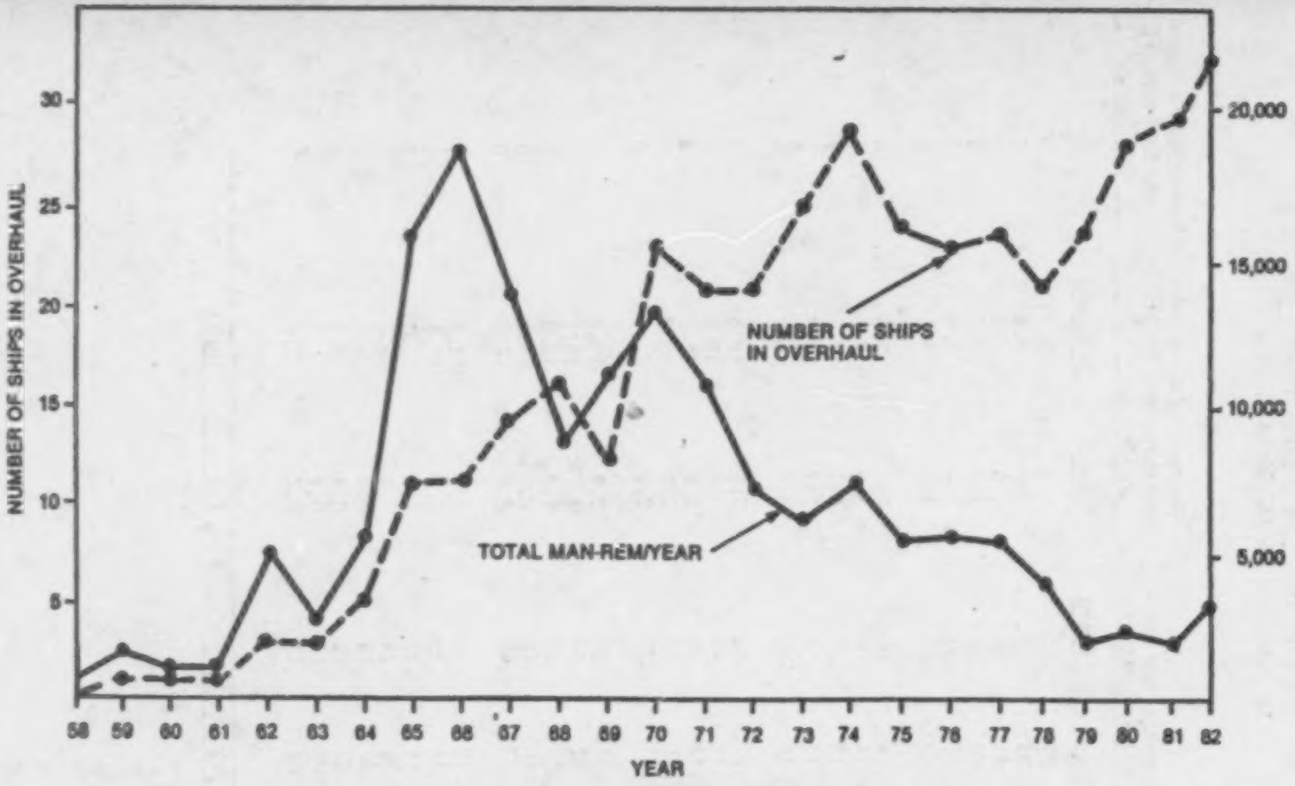

FIGURE 2

TOTAL RADIATION EXPOSURE RECEIVED BY SHIPYARD PERSONNEL FROM WORK ASSOCIATED WITH NAVAL NUCLEAR PROPULSION PLANTS 1958-1982

TABLE 4
SHIPYARD AND FLEET DISTRIBUTION OF PERSONNEL RADIATION EXPOSURE

Year	Average Rem Per Person Monitored		Percent of Personnel Monitored Who Received Greater Than 1 Rem		Number of Personnel Who Exceeded 3 Rem/Quarter
	Fleet	Shipyard	Fleet	Shipyard	
1954	.22	.12	0	3.8	0
1955	.25	.13	10.9	4.3	0
1956	.41	.06	11.5	1.0	0
1957	.20	.14	2.7	3.7	0
1958	.17	.13	2.4	3.9	0
1959	.18	.17	4.7	4.6	8
1960	.14	.09	7.5	2.6	0
1961	.14	.09	2.9	2.5	0
1962	.18	.33	4.3	9.5	9
1963	.15	.13	2.7	3.7	2
1964	.18	.22	4.4	6.4	4
1965	.27	.56	7.5	19.8	5
1966	.19	.52	4.6	18.5	6
1967	.14	.39	2.5	16.2	3
1968	.10	.26	2.0	8.8	0
1969	.11	.37	2.7	13.5	0
1970	.11	.50	2.9	18.3	0
1971	.12	.44	2.7	16.2	0
1972	.10	.35	2.3	13.3	0
1973	.10	.40	2.3	14.5	0
1974	.11	.48	2.0	17.0	0
1975	.12	.36	2.0	12.5	0
1976	.14	.35	2.4	12.9	0
1977	.14	.33	2.3	12.0	0
1978	.10	.24	1.4	8.5	0
1979	.07	.13	0.4	1.5	0
1980	.07	.15	0.4	2.4	0
1981	.06	.13	0.1	1.7	0
1982	.06	.17	0.2	3.3	0
Average	.12	.32	2.2	10.9	
NAVYWIDE AVERAGE	.22		6.8		

TABLE 5
DISTRIBUTION OF TOTAL LIFETIME RADIATION EXPOSURE ASSOCIATED WITH NAVAL NUCLEAR PROPULSION PLANTS

Range of Accumulated Lifetime Radiation Exposure (REM)	Percentage of Personnel Monitored in 1982 with Lifetime Accumulated Radiation Exposure in the Radiation Range
0 - 5	99.30
5 - 10	0.64
10 - 15	0.05
15 - 20	0.01
20 - 25	0
25 - 30	0
30 - 50	0
Greater than 50	0

Table 6 provides a basis for comparison between the radiation exposure for light water reactors operated by the Navy and commercial power reactors licensed by the Nuclear Regulatory Commission. The 1981 data in this Nuclear Regulatory Commission table covers 70 licensees with a total of 54,142 man-rem (ref 11). The 1981 average annual exposure of each worker at commercial power reactors was 0.43 rem.* Licensees of commercial power reactors reported 251 overexposures to external radiation during the years 1971 through 1981. Numbers in excess of 5 rem are not necessarily overexposures since Nuclear Regulatory Commission regulations permit exposures of 3 rem each quarter up to 12 rem per year within the accumulated total limit of 5 rem for each year of a person's age beyond eighteen.

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*This average was calculated by dividing total man-rem by total number of workers monitored as is done in Table 4. Ref (11) reports this value as 0.66; however, it is calculated by dividing the total man-rem by the number of workers with measurable exposure.

TABLE 6
PERSONNEL
RADIATION EXPOSURE FOR COMMERCIAL NUCLEAR-POWERED REACTORS LICENSED BY U.S. NUCLEAR REGULATORY COMMISSION
SUMMARY OF ANNUAL WHOLE BODY EXPOSURE BY INCREMENT

YEAR	TOTAL MONITORED	NUMBER OF INDIVIDUALS EXPOSURE INCREMENT - REM												Total Man-Rem	No. Of Over-Exposures
		NOT MEASURABLE	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	>10		
1969	2838	2607			134	65	25	5	2	0	0	0	0		
1970	7509	6985			166	163	88	98	8	1	0	0	0		
1971	9581	8996			315	137	105	17	11	0	0	0	0		2
1972	15713	14783			532	199	111	46	21	9	6	6	0		16
1973	33823	19043	9798	2468	1584	422	251	71	38	16	7	0	0	13963	19
1974	38938	20472	13766	2503	1378	471	226	86	30	6	0	0	0	13722	43
1975	44343	18852	18289	3948	1872	691	423	169	60	24	12	0	1	20879	14
1976	61151	25704	24606	4880	2354	789	487	188	70	26	11	5	1	26433	20
1977	67134	24868	31298	6162	2837	1130	569	141	66	36	21	6	0	32511	27
1978	76121	30143	34983	6409	2989	1080	418	67	26	8	0	0	2	31804	9
1979	105313	41191	51056	7898	3306	1255	477	86	28	13	2	0	1	39981	21
1980	127708	47377	61808	11474	4515	1537	686	192	98	18	3	0	0	53796	73
1981	124506	42323	63403	11766	4546	1793	486	93	81	11	2	1	1	54142	7

SOURCE: NUREG-0713, Vol. 3, "Occupational Radiation Exposure at Commercial Nuclear Power Reactors 1981."

INTERNAL RADIOACTIVITY

Policy and Limits

The Navy's policy on internal radioactivity for personnel associated with the nuclear propulsion program continues to be the same as it was more than two decades ago—to prevent significant radiation exposure to personnel from internal radioactivity. The limits invoked to achieve this objective are one-tenth of the levels allowed by Federal regulations for radiation workers. The results of this program have been that no one has received more than one-tenth the Federal annual internal occupational exposure limits from internal radiation exposure caused by radioactivity associated with Naval nuclear propulsion plants.

The basic Federal limit for radiation exposure to organs of the body from internal radioactivity has been 15 rem per year. There have been higher levels applied at various times for thyroid and for bones; however, use of these specific higher limits has not been necessary in the Naval Nuclear Propulsion Program.

Fifteen rem per year is the limit recommended for most organs of the body by the U. S. National Committee on Radiation Protection in 1954 (ref 1), by the U. S. Atomic Energy Commission in the initial edition of ref 3 applicable in 1957, by the International Commission on Radiological Protection in 1959 (ref 2), and was adopted for Federal agencies when President Eisenhower approved recommendations of the Federal Radiation Council May 13, 1960. Although the International Commission on Radiological Protection revised its recommendations in 1977 (ref 8) to raise limits for most organs, the Naval Nuclear Propulsion Program has not changed the limits.

Source of Radioactivity

Radioactivity can get inside the body through air, through water or food, and through surface contamination via the mouth, skin or a wound. The radioactivity of primary concern is the metallic corrosion products on the inside surfaces of reactor plant piping systems. These are in the form of insoluble metallic oxides, primarily iron oxides. Ref (12) contains more details on why cobalt 60 is the radionuclide of most concern for internal radioactivity.

The design conditions for reactor fuel are much more severe for warships than for commercial power reactors. As a result of being designed to withstand shock, naval reactor fuel elements retain fission products including fission gases within the fuel. Sensitive measurements are made frequently to verify the integrity of reactor fuel. Consequently, fission products such as strontium 90 and cesium 137 make no measurable contribution to internal exposure of personnel from radioactivity associated with Naval nuclear propulsion plants. Similarly, alpha emitters such as uranium and plutonium are retained within the fuel elements and are not accessible to personnel operating or maintaining a Naval nuclear propulsion plant.

Because of the high integrity of reactor fuel and because soluble boron is not used in reactor coolant for normal radioactivity control in Naval reactors, the amounts of tritium in reactor coolant are far less than in typical commercial power reactors. The small amounts that are present are formed primarily as a result of neutron interaction with the deuterium naturally present in water. The radiation from tritium is of such low energy that the Federal limits for breathing or swallowing tritium are one hundred times higher than for cobalt 60. As a result radiation exposure to personnel from tritium is far too low to measure. Similarly, the low energy beta radiation from carbon 14 does not add measurable radiation exposure to personnel operating or maintaining Naval nuclear propulsion plants.

Control of Airborne Radioactivity

Airborne radioactivity is controlled in maintenance operations such that masks are not normally required. To prevent exposure of personnel to airborne radioactivity when work might expose radioactivity to the atmosphere, contamination containment tents or bags are used. The areas inside these containments are ventilated to the atmosphere through high efficiency filters which have been tested to remove at least 99.95 percent of particles of a size comparable to cigarette smoke. The occupied area outside these containments is required to be ventilated through high efficiency filters any time work which could cause airborne radioactivity is in progress inside an area such as a reactor compartment. Airborne radioactivity surveys are required to be performed regularly in radioactive work areas. Any time airborne radioactivity above the limit is detected in occupied areas, work which might be causing airborne radioactivity is stopped. This conservative action is taken to minimize internal radioactivity even though the Navy's airborne radioactivity limit would allow continuous breathing for forty hours per week throughout the year to reach an annual exposure to the lungs of one-tenth the Federal limit. Personnel are also trained to use masks when airborne radioactivity above the limit is detected. However, masks are seldom needed and are not relied upon as the first line of defense against airborne radioactivity.

It is not uncommon for airborne radioactivity above the limit to be caused by radon naturally present in the air. Atmospheric temperature inversion conditions can allow this buildup of radioactive particles from radon. Radon can build up above the limit in sealed or poorly ventilated rooms in homes or buildings made of stone. Most cases of airborne radioactivity above the limits in occupied areas in the Naval Nuclear Propulsion Program have been caused by radioactive particles from radon and not from the reactor plant. Procedures have been developed to allow work to continue after it has been determined that the elevated airborne radioactivity is from naturally occurring radon.

Radon is also emitted from radium used for making dials luminous. There have been a number of cases where a single radium dial such as on a wristwatch has caused the entire atmosphere of a submarine to exceed the airborne radioactivity limit used for the nuclear propulsion plant. Radium in any form has been banned from submarines to prevent interference with keeping airborne radioactivity from the nuclear propulsion plant as low as practicable.

Control of Radioactive Surface Contamination

Perhaps the most restrictive regulations in the radiological control program are established in the requirements for the control of radioactive contamination. Work operations involving potential for spreading radioactive contamination are planned using containment to prevent personnel becoming contaminated. The controls for radioactive contamination are so strict that precautions sometimes have had to be taken to prevent tracking contamination from fallout and natural sources into nuclear areas because the contamination control limits used in the nuclear areas were below the levels of fallout and natural contamination occurring outside in the general public areas.

Anticontamination clothing, including coveralls, hood (to cover the head, ears and neck), shoe covers and gloves, is provided when needed. However, the basic approach is to avoid the need for anticontamination clothing by containing the radioactivity. As a result, most work on radioactive materials is performed with hands reaching into gloves installed in containments, making it unnecessary for the worker to wear anticontamination clothing. In addition to providing better control over the spread of radioactivity, this method has reduced radiation exposure since the worker can usually do his job better and faster in his normal work clothing. A basic requirement of contamination control is monitoring all personnel leaving any area where radioactive contamination could possibly occur. Workers are trained to survey themselves, and their performance is checked by radiological control personnel. Personnel monitor before, not after, they wash. Therefore, washing or showering at the exit of radioactive work areas is not required. The basic approach is to prevent contamination, not wash it away.

Surveys for radioactive contamination are taken frequently by trained radiological control personnel. Results of these surveys are reviewed by supervisory personnel to provide a double-check that no abnormal conditions exist. The instruments used for these surveys are checked against a radioactive calibration source daily and prior to use, and they are calibrated at least every six months.

Control of Food and Water

Smoking, eating, drinking and chewing are prohibited in radioactive areas. Aboard ship, drinking water is distilled from seawater by using steam. However, the steam is not radioactive because it is in a secondary piping system separate from the reactor plant radioactive water. In the event radioactivity were to leak into the steam system, sensitive radioactivity detection instruments which operate continuously would give early warning.

Wounds

Skin conditions or open wounds which might not readily be decontaminated are cause for disqualification from doing radioactive work. Workers are trained to report such conditions to radiological control or medical personnel, and radiological control technicians watch for open wounds when workers enter radioactive work areas. In the initial medical examination prior to radiation work and during subsequent examinations, skin conditions are also checked. If the medical officer determines a wound is sufficiently healed or considers the wound adequately protected, he may remove the disqualification.

There have been only a few cases of contaminated wounds in the Naval Nuclear Propulsion Program. In most years, none occurred. Examples of such injuries which have occurred in the past include a scratched hand, a metallic sliver in a hand, a cut finger, and a puncture wound to a hand. These wounds occurred at the same time the person became contaminated. Insoluble metallic oxides which make up the radioactive contamination remain primarily at the wound rather than being absorbed into the blood stream. These radioactively contaminated wounds have been easily decontaminated. No case of a contaminated wound is known where the radioactivity initially present in the wound was as much as one one-thousandth of that permitted for a radiation worker to have in his body.

Monitoring for Internal Radioactivity

The radioactivity of most concern for internal radiation exposure from Naval nuclear propulsion plants is cobalt 60. Although most radiation exposure from cobalt 60 inside the body will be from beta radiation, the gammas given off make cobalt 60 easy to detect. Complex whole body counters are not required to detect cobalt 60 at low levels inside the body. For example, one millionth of a curie of cobalt 60 inside the lungs or intestines will cause a measurement of two times above the background reading with a standard radiation survey instrument. This amount of internal radioactivity will cause the instrument used to monitor personnel for radioactive contamination on their body to reach the alarm level. Every person is required to monitor his entire body every time he leaves an area with radioactive surface contamination. Monitoring the entire body is a requirement in the Naval Nuclear Propulsion Program; monitoring just hands and feet is not permitted. Therefore, if a person had as little as a millionth of a curie of cobalt 60 inside him, it would readily be detected.

Swallowing one millionth of a curie of cobalt 60 will cause internal radiation exposure of about 0.06 rem. The radioactivity will pass through the body and be excreted within a period of a little more than one day.

One millionth of a curie of cobalt 60 deposited in the lungs as a result of an inhalation incident is estimated to cause a radiation exposure of about 3 rem to the lungs over the following year based on standard calculational techniques recommended by the International Commission on Radiological Protection, (ref 13). These techniques provide a convenient way to estimate the amount of radiation exposure a typical individual might be expected to receive from small amounts of internally deposited radioactivity. These techniques account for the gradual removal of cobalt 60 from the lungs through biological processes and the radioactive decay of cobalt 60 with a 5.3 year half life. However, if an actual case were to occur, the measured biological elimination rate would be used in determining the amount of radiation exposure received.

In addition to the control measures to prevent internal radioactivity and the whole body monitoring frequently performed on those who work with radioactive materials, more sensitive monitoring is also performed during radioactive overhaul work. Shipyard procedures for monitoring internal radioactivity use the type of scintillation detectors which will reliably detect an amount of cobalt 60 inside the body that is more than one hundred times lower than the one millionth of a curie used in the examples above. Shipyards typically monitor for internal radioactivity as part of each radiation medical examination, performed before an employee initially performs radiation work, after he terminates radiation work, and periodically in between. Shipyards also monitor periodically during the year groups of personnel who did the work most likely to have caused spread of radioactive contamination. Any person who has radioactive contamination above the limit anywhere on the skin of his body during regular monitoring at the exit from a radioactive area is monitored for internal radioactivity with the sensitive detector. Also any person who might have breathed airborne radioactivity above limits is monitored with the sensitive detector.

Results of Internal Monitoring in 1982

During 1982 over 10,000 personnel were monitored for internally deposited radioactivity using sensitive scintillation detectors at the eight shipyards performing work associated with Naval nuclear propulsion plants. Equipment and procedures provide detection levels at least one hundred times lower than one-millionth of a curie. Only one person had internal radioactivity above this level due to activity ingested during 1982 when a containment in which the individual was working was over pressurized. He had 0.012 millionths of a curie in his gastrointestinal system and lungs; the radionuclide was insoluble cobalt 60. After four days, the quantity of internally deposited radioactivity had decreased to less than 0.01 millionth of a curie due to elimination by natural biological processes. The individual received 4.0 mrem to his lower large intestines as the radioactivity passed through his gastrointestinal system and will receive approximately 32 mrem to his lungs over his lifetime.

EFFECTS OF RADIATION ON PERSONNEL

Control of radiation exposure in the Naval Nuclear Propulsion Program has always been based on the assumption that any exposure, no matter how small, involves some risk; however, exposure within the accepted exposure limits represents a risk small compared with normal hazards of life. The basis for this statement is presented below.

Exposure to Radiation Involves Some Risk

Since the inception of nuclear power, scientists have cautioned that exposure to ionizing radiation in addition to that from natural background involves some risk. The National Committee on Radiation Protection and Measurements in 1954 (ref 1) and the International Commission on Radiological Protection in 1958 (ref 2) both recommended that exposures should be kept as low as practicable and that unnecessary exposure should be avoided to minimize this risk. The International Commission on Radiological Protection in 1962 (ref 14) explained the assumed risk as follows:

> "The basis of the Commission's recommendations is that any exposure to radiation may carry some risk. The assumption has been made that, down to the lowest levels of dose, the risk of inducing disease or disability in an individual increases with the dose accumulated by the individual, but is small even at the maximum permissible levels recommended for occupational exposure."

The National Academy of Sciences-National Research Council Advisory Committee on the Biological Effects of Atomic Radiation included similar statements in its reports in the 1956-1961 period. In 1960, the Federal Radiation Council stated in ref 4 that its radiation protection guidance did not differ substantially from recommendations of the National Committee on Radiation Protection and Measurements, the International Commission on Radiological Protection, and the National Academy of Sciences.

One conclusion from these reports is that radiation exposures to personnel should be minimized. This is not a new conclusion. It has been a major driving force of the Naval Nuclear Propulsion Program.

Studies of the Effects of Radiation on Humans

Tens of thousands of reports have been written on the effects of radiation. Even the list of summary reports is voluminous. In spite of the fact that there are many unanswered questions concerning the effects of radiation on humans, more is known about radiation than almost any substance that can affect humans. More money has been spent to learn the effects of radiation on humans than for any other hazard in our modern society. In fact, the National Academy of Sciences in ref 15 stated: "It is fair to say that we have more scientific evidence on the hazards of ionizing radiation than most, if not all, other environmental agents that affect the general public."

The main effect is cancer. Effects other than cancer have not been found for low-level radiation exposure to adults. The following brief summary of the effects of low-level whole body external radiation is primarily from refs 15 and 16.

The most important data on the effects of whole body external radiation exposure on humans comes from the almost 30 years of extensive study of the Japanese atomic bomb survivors. In addition, studies have been made of the Marshall Islands inhabitants who received about 12,000 man-rem from fallout in 1954. Studies have been made on groups of patients who have had frequent diagnostic x-ray examinations. Numbers of studies have been made on patients who have had radiation therapy for a disease of the bones of the back and for other conditions. These studies predominantly involved radiation doses of greater than 100 rem. The determinations of damage from doses greater than 100 rem have been reasonably consistent from numerous different studies. Extensive irradiation studies of animals have also been used to show what to look for in humans. These animal studies also show under controlled conditions not available in studies on humans how the radiation effects change with amount and frequency of radiation exposure.

Results of radiation studies on humans show the highest rates of cancer occur in the thyroid and the female breast, although the death rate for thyroid cancer is low. The cancer rates from radiation are lower for leukemia and lung cancer, and lower still for cancers of the bone and other organs. Leukemia has been associated with radiation exposure in almost every study of radiation on humans. Reasons for this include the improved diagnosis of leukemia in recent decades and the low natural incidence of leukemia compared to other cancers. However one type of leukemia, chronic lymphatic leukemia, has not been found in any study to be associated with radiation. Some organs appear to be so resistant to radiation-induced cancer that there has been no clear association between radiation and cancer in these organs. One example is the prostate gland.

One characteristic of cancer caused by low-level radiation is the long delay time between time of radiation exposure and time of diagnosis of cancer. Cancer is not diagnosed until more than a few years have elapsed. In the Japanese atomic bomb survivors, the end of the latent period for leukemia was about 25 years. For the sum of all types of cancers, ref 16 assumes that in 25 years one-half the cancers will have occurred.

Cataracts of the eyes can be caused by radiation. However, cataract formation appears to have more evidence of having a threshold radiation dose than any other radiation damage studied. Very high radiation doses have been required to produce cataracts. Ref 15 states that single exposures of 200 to 500 rem or fractionated exposures of 1000 rem are the threshold exposures required to produce damage to the lens of the eye sufficient to interfere with vision.

Genetic effects can also be caused by radiation. However, genetic effects greater than the natural incidence rate have not been demonstrated in human populations exposed to radiation. Genetic effects are changes in human genes that do not pose a risk to the parent but could cause birth defects in offspring. The current natural rate of genetic effects is approximately 10 percent of all live births and range from trivial effects, such as hair and eye color changes, to more serious disorders. No increase in the natural rate of genetic effects has been found in studies of the 35,000 children conceived by parents irradiated as a result of the nuclear explosions in Hiroshima or Nagasaki in 1945.

Sterility, which is not a genetic effect, can be caused by radiation. However, according to ref 15, the radiation exposure required to cause sterility in males is very high, probably in excess of lethal exposures. Scientific reports of several decades ago speculated that radiation might cause a general effect that would shorten life, similar to aging. Reports in the last decade conclude such an effect has not been found in studies on humans. Nor have numerous other diseases such as heart disease been associated with radiation in these studies. To date the chief effect of radiation on humans has been found to be cancer.

In 1980, the National Institute for Occupational Safety and Health issued a report (ref 17) concerning the health of Portsmouth Naval Shipyard workers.

In 1978, Dr. T. Najarian, assisted by the Boston Globe, issued a sensationalized report which alleged that Portsmouth Naval Shipyard (PNS) workers who were occupationally exposed to low-level radiation suffered twice the expected rate of overall cancer deaths and five times the expected rate of leukemia deaths. This report was based on an informal review of several hundred death records, without any official input. It caused a number of frightening news stories. NIOSH was subsequently directed by Congress to investigate Dr. Najarian's report.

Under contract with NIOSH, Dr. Najarian's study was repeated using data the Navy made available to NIOSH. In June 1979, Dr. Najarian testified before Congress on the results of the reanalysis based on official data. In his testimony Dr. Najarian repudiated his earlier findings of increased overall cancer and leukemia. His third finding of increased blood cancers was separately repudiated at that time by the National Cancer Institute.

In December 1980, NIOSH finished their investigation based on approximately 25,000 Portsmouth Naval Shipyard workers and issued a final report. This report states that NIOSH found no excess of deaths due to leukemia or other cancers among the Shipyard workers. This report specifically states:

> "No relationship between exposure to radiation and mortality from any cause was observed among the PNS population when compared to the United States white male population. Furthermore, no excess in leukemia mortality was observed in the radiation exposed population when compared to the non-radiation exposed employees of PNS."

Thus, the earlier reports of excess cancer rates among Portsmouth Naval Shipyard workers exposed to low-level radiation were not substantiated by NIOSH.

The Department of Energy is sponsoring a more comprehensive shipyard epidemiologic study. The study is being performed by Johns Hopkins University and will include radiation workers in all shipyards doing Naval nuclear propulsion plant work so that its findings will be based on a much larger population. Because of the size of the study, results are not expected for several years.

Numerical Estimates of Risk from Radiation

In 1972, both the United Nations Scientific Committee on the Effects of Atomic Radiation and the National Academy of Sciences-National Research Council Advisory Committee on the Biological Effects of Ionizing Radiations issued reports (refs 18 and 19) which estimated numerical risks for specific types of cancer from radiation exposure to humans. In 1977, both the International Commission on Radiological Protection and the United Nations Scientific Committee on the Effects of Atomic Radiation issued reports (refs 8 and 16) reconfirming these risk estimates. The risk estimates from both refs 8 and 16 can be briefly summarized as follows:

> In a large population group (such as 100,000 people) receiving an annual total of 10,000 man-rem year after year, the increased risk from this radiation appears to be in the region of about one fatal cancer case each year and about one leukemia case every five years in excess of the normal numbers of cases.

This can be used to develop a risk estimate for personnel exposed to radiation associated with Naval nuclear propulsion plants. In all shipyards there have been a total of about 122,000 personnel monitored for exposure to radiation, and their exposure rate has averaged less than 6,000 man-rem per year. Therefore, there should be less than one excess fatal cancer per year and less than one excess leukemia case every five years among the total 122,000 shipyard personnel who have ever been monitored for radiation associated with Naval nuclear propulsion plants.

According to refs 8 and 16, this risk estimate is likely to be substantially overstated because the radiation exposures are from gamma radiation at low doses and low dose rates. Also, exposure to neutrons and exposure from internal radioactivity in the Naval Nuclear Propulsion Program are too low to have the confusing effects noted in some studies of the effects of radiation on humans. The National Academy of Sciences-National Research Council Committee on Biological Effects of Ionizing Radiation issued a report in 1980 (ref 15) which also stated that the risk estimates in refs 8 and 16 for low-level exposure may be overestimated. This report recommended that the risk of dying of cancer from low-level radiation exposure be estimated based on a model which yields lower risk estimates than those reported in refs 8 and 16. For simplicity, the discussion which follows will use the earlier conservative estimates in refs 8 and 16.

Radiation exposure received by Naval personnel assigned to nuclear-powered ships and their support facilities has averaged less than 2000 man-rem per year. Therefore, according to refs 8 and 16 there should be less than one excess fatal cancer every five years and less than one excess leukemia case every twenty-five years among the approximately 54,000 Naval personnel who have ever been monitored for occupational exposure to radiation associated with Naval nuclear propulsion plants. Since only a few percent of the total man-rem to ship personnel is from neutrons, the same qualifications apply as were mentioned for shipyard personnel, and this risk estimate is likely to be substantially overestimated.

Radiation Exposure Comparisons

To help put this risk estimate in perspective, comparisons are needed. For example, in a typical group of 10,000 people in the U. S., a total of 1600 will die of cancer (ref 20). If each of the 10,000 received over his lifetime one rem more than he was already receiving from background and medical sources, then according to the preceding risk estimate one extra person would die of cancer. Therefore, the 1600 cancer deaths would increase to 1601 for this group of 10,000. This example is directly applicable to the Naval Nuclear Propulsion Program where the average lifetime occupational radiation exposure is one rem.

However, a few highly controversial studies have concluded that more people would die from radiation than the National Academy of Sciences and United Nations committees predict. If the higher risk estimate of one well known study is applied to the same population group of 10,000, then the 1600 cancer deaths would increase to 1610.

The current controversy over effects of low-level radiation is whether one extra rem to each of 10,000 people will cause the normal number of 1600 cancer deaths to increase to 1601, or to 1610. The 1601 figure is the current best estimate. Studies are now underway to attempt to refine the accuracy of the estimates.

The following examples give further perspective on what radiation exposure means:

- Of all industrial and medical radiation workers in the United States, about 15,000 die each year from cancer. It is estimated that only 25 additional cancer deaths occur per year as a result of radiation exposure from their work.

- Radiation from the nuclear accident at Three Mile Island may add one fatal cancer death to the public within fifty miles. Of the two million people living within this fifty mile radius, more than 300,000 are expected to die of cancer from causes other than the radioactivity released from this accident.

- The average occupational radiation exposure of all those monitored in the Naval nuclear propulsion program is about 0.23 rem per year. This is only slightly greater than the average radiation exposure received in the U. S. each year from natural background and medical x-rays. (Derived from ref 21).

- The average lifetime occupational radiation exposure of one rem for personnel in the Naval nuclear propulsion program is less than one tenth the amount of radiation exposure these same personnel will average over their lifetimes from natural background and medical x-rays. (Derived from ref 21).

- This one rem average lifetime occupational radiation exposure can also be compared very roughly to the 5 rem received in a year from smoking one pack of cigarettes per day. This comparison is not exact because it requires more lung exposure from natural radioactivity in tobacco to cause the same amount of risk as whole body gamma radiation. (ref 22)

- The risk of dying from an automobile accident is forty or more times higher than the risk of fatal cancer for the average person with 1 rem lifetime radiation exposure.

The total occupational radiation exposure of 5013 man-rem received by all personnel in the Naval Nuclear Propulsion Program in 1982 can be compared to the many other sources of radiation exposure received by the U. S. population. Examples follow:

- 20,000,000 man-rem to the population of the U. S. each year from natural background radiation (ref 21).

- 17,000,000 man-rem to the population of the U. S. each year from medical and dental radiation (ref 21).

- 650,000 man-rem to the population of the U. S. each year from radioactivity in natural gas used for cooking (ref 22).

- 100,000 man-rem the one million inhabitants of Denver could save each year if they moved to a region such as Washington, D. C. with lower natural background radiation levels (Derived from ref 21).

- 12,000 man-rem total to passengers in jet airplane flights in the United States from increased cosmic radiation at the higher altitudes used by jets (ref 23).

Thus, the total occupational radiation exposure received by all personnel in 1982 is about one ten-thousandth of the total radiation exposure received by the U. S. population from all sources. The risk from occupational radiation exposure in the Naval Nuclear Propulsion Program is also less than the risks these same personnel face from natural background radiation or from medical radiation. To demonstrate this, the 122,000 personnel monitored for radiation in all shipyards over the last 29 years will receive about 12,200 man-rem per year from natural background and about the same from medical radiation. The average occupational exposure to this group has been less than 6,000 man-rem per year.

Risk estimates for radiation should also be compared to other risks normally encountered in industrial activities, using the following table for example:

DEATH RATES IN U. S. FOR VARIOUS CAUSES

CAUSE	ANNUAL DEATHS PER 100,000 POPULATION
Smoking (ref 24)	150
Motor Vehicle accidents (ref 25)	22
Work accidents (ref 25)	-
Mining, quarrying	63
Construction	57
Agriculture	54
Transportation and Public Utilities	31
All Industries Average	14
Government	11
Services	9
Manufacturing	9
Trade	6
Industrial accidents in a Naval Shipyard (eight shipyards 1972-1977)	7
Commercial air travel (ref 25)	1
Coal-fired electric power (estimate derived from ref 26)	1 to 10
Radiation associated with Naval Nuclear propulsion plants (risk estimate)	Less than 1

Because of these estimates on the risk of low-level radiation, extra hazard pay for radiation work has never been paid in the Naval Nuclear Propulsion Program. Civil Service Commission regulations do not provide for hazard pay for radiation work. A serious disadvantage to extra pay for radiation risks is that it would tend to increase the difficulty in minimizing radiation exposure because some personnel would press for more radiation to maximize their pay.

Extrapolations

In radiation, as in other areas, a most effective way to frighten people is to proclaim that no one knows what the effects are. This has been repeated so often that it has almost become an article of faith that no one knows the effects of low-level radiation on humans.

One could well state, "No one knows the risks of smoking a few cigarettes," but the risks of smoking a large number of cigarettes are well known. If 10,000 people smoke an average of four cigarettes a day, about 100 deaths will result; data are not available for lower smoking rates. For radiation, doses of 100 rem to each of 10,000 people would be required to cause an equal number of deaths. The effects of radiation on humans at doses of 100 rem are well known. The controversy over radiation risks today is how to extend the risk estimates to even lower levels. As we get to lower levels, it becomes more and more difficult to detect the effects.

The figures just presented can be extended to show that one rem has about the same risk of death as smoking one cigarette per month. This comparison is only to show that finding out the effect on the death rate of one rem of exposure is about the same as trying to find out the effect of smoking one cigarette a month.

In summary, the effect of one rem is extremely small. There are physical limits to how far scientists can go to ascertain precisely the size of this risk, but it is known to be small. Instead of proclaiming how little is known about low-level radiation, it is more appropriate to emphasize how much is known about the small actual effects.

Conclusions on the Effects of Radiation on Personnel

This perspective provides a better position to answer the question, "Is radiation safe?" If safe means zero effect, then the conclusion would have to be that radiation is unsafe. But to be consistent, background radiation and medical radiation would also have to be considered unsafe. Or more simply, being alive is unsafe.

"Safe" is a relative term. Comparisons are necessary for actual meaning. For a worker, safe means the risk is small compared to other risks accepted in normal work activities. Aside from work, safe means the risk is small compared to other risks routinely accepted in life.

Each recommendation on limits for radiation exposure from the key organizations referenced has emphasized the need to minimize radiation exposure. Thus, the Navy is committed to keeping radiation exposure to personnel as low as reasonably achievable. No level of radiation exposure has been identified for which responsible organizations have stated there is no effect. Similarly it is difficult to find a single activity of man for which one can confidently state the risk is zero. However, the above summaries show that the risk from radiation exposure associated with Naval nuclear propulsion plants is low compared to hazards normally accepted in industrial work and in daily life outside of work.

CLAIMS FOR RADIATION INJURY TO PERSONNEL

Personnel who consider they have or might have had occupational injury may file claims. Naval shipyard personnel are employees of the U. S. Government and therefore file claims with the U. S. Department of Labor's Office of Workmen's Compensation. Shipyards hold no hearing on injury claims. They are not handled in an adversary procedure. The Navy has no rights to present a case to the Labor Department. The claim does not even have to be filed through the shipyard. The shipyard is not permitted to appeal a decision, but employee may appeal. The primary consideration in the Federal laws and procedures set up for injury compensation is to take care of the Federal employee. The program to compensate Federal employees is well publicized.

In private shipyards injury compensation claims are handled under the Longshoremen's and Harbor Workers' Compensation Act. The claim may be handled through the shipyard's insurance carrier or by a U. S. Department of Labor claims examiner. Either the employee or the employer may appeal.

Claims for military personnel concerning prior duty are handled through the Veterans Administration.

There have been a total of 143 claims filed for injury from radiation associated with Naval nuclear propulsion plants. Ninety-six originated from employees of the six Naval shipyards, thirty-one from private shipyards and sixteen from Navy personnel. These claims are summarized in Table 7. As shown in Table 7 more than half the claims have been filed for injuries other than cancer or leukemia. Three-fourths of the claims filed for cancer or leukemia involved workers with lifetime radiation exposures less than the 5 rem a nuclear worker is permitted to receive in one year by Federal Regulations.

Three suits have been filed in court alleging injury from radiation. One claim involves leukemia; the other two do not involve a cancer. One was dismissed in 1979, and the other two are still in litigation.

Six claims have been awarded, two for leukemia in 1968 and 1979, three for cataracts of the eyes in 1971, 1974 and 1977, and one for leukocytosis in 1969. The Navy considers all six of these awards were unjustified:

- One leukemia case had an occupational exposure of 5.38 rem. The claimant had also received hundreds of rem in medical radiation exposure for adenoids. If radiation were to be selected as the cause of this leukemia, then the occupational exposure could not have been more than a tiny part of the total radiation exposure.
- The second leukemia case had a total occupational exposure of 1.00 rem. This amount of radiation exposure is small and less than 10 percent of the amount of exposure the claimant will receive during his life from natural background and medical radiation.
- Two of the cataract cases had total lifetime radiation exposures of about 3 rem, and one case had less than 1 rem. These exposures are hundreds of times smaller than needed to produce cataracts in the eyes.
- The leukocytosis (elevated white blood cell count) case had a total occupational exposure of 15.5 rem which was received over an eight year period. This case was evaluated by the medical research center of a national laboratory, which concluded that the cause of the leukocytosis was unknown. In addition, leukocytosis has not been shown to be associated with low-level occupational radiation exposure.

From the radiation injury claims filed to date, the Navy has been unable to draw any conclusions concerning radiation injury to personnel occupationally exposed to radiation associated with Naval nuclear propulsion plants.

TABLE 7

CLAIMS FOR RADIATION INJURY TO PERSONNEL

Injury Claimed	Claims Filed	Claims Awarded	Claims Denied, Inactive or Deferred	Claims Active
Leukemia	22	2	13	7
Cancer Other Than Leukemia	42	0	31	11
Other	80	4	51	25
Total	144	6	95	43

AUDITS AND REVIEWS

Checks and cross-checks and audits and inspections of numerous kinds have been shown to be essential in maintaining high standards of radiological control. First, each worker is specially trained in radiological control as it relates to his own job. Second, written procedures exist which require verbatim compliance. Third, radiological control technicians and their supervisors oversee radioactive work. Fourth, personnel independent of radiological control technicians are responsible for personnel radiation exposure records.

Fifth, a strong independent audit program is required covering all radiological control requirements. In all shipyards this radiological audit group is independent of the radiological control organization and its findings are reported regularly to senior shipyard management, including the shipyard commander. This group performs continuing surveillance of radioactive work. It conducts in-depth audits of specific areas of radiological control. This group checks all radiological control requirements at least annually.

Sixth, the U. S. Department of Energy assigns to each shipyard a representative who reports to the Director of the Naval Nuclear Propulsion Program at headquarters. One assistant to this representative is assigned full time to audit radiological controls, both in nuclear-powered ships and in the shipyard. Seventh, Naval Nuclear Propulsion Program headquarters personnel conduct periodic inspections of radiological control in each shipyard. Similarly, there are multiple levels of audits and inspections for the other Naval shore facilities, tenders, and nuclear-powered ships.

ABNORMAL OCCURRENCES

It is a fact of human nature that people make mistakes. The key to a good radiological control program is to find the mistakes while they are small and prevent the combinations of mistakes that lead to accidents. The preceding section on inspections supports the contention that more attention is given to errors and their prevention in the Naval Nuclear Propulsion Program than to any other single subject. Requiring constant focus on improving performance of radiological work has proven effective in reducing errors.

In addition, radiological control technicians are authorized and required to stop anyone performing work in a manner which could lead to radiological deficiencies. A deficiency, of course, is failure to follow a written procedure verbatim. However, the broadest interpretation of the term "deficiency" is used in the Navy's radiological control program. Anything involved with radiation or radioactivity which could have been done better is also a radiological deficiency.

Radiological deficiencies receive management attention. But there is a higher level of deficiency that is defined as a radiological incident. Incidents attract a great deal of notice, including the personal attention of the Director of the Naval Nuclear Propulsion Program at headquarters. Improvement programs over the years have constantly aimed at reducing the numbers of radiological incidents. As improvements occurred, the definition of what constituted an incident was changed to define smaller deficiencies as incidents. These changes were necessary so that the incident reporting system would continue to play a key role in upgrading radiological controls. As a result, it is not practicable to measure performance merely by counting numbers of radiological incidents or deficiencies.

There is a reporting system that has been nearly constant over time and therefore can be used as a basis for comparison. The Department of Energy and its predecessors have used these levels of severity to define radiological occurrences (ref 27). Examples of radiation exposure incidents in each type follow:

- Type A - external radiation exposure over 25 rem in one incident
- Type B - external radiation exposure over 5 rem in one incident
- Type C - external whole body radiation exposure over 3 rem in one quarter year

The Nuclear Regulatory Commission also has criteria defining abnormal occurrences. The Navy regularly evaluates radiological events using these criteria for comparison; results are reported in Table 8.

TABLE 8

ABNORMAL OCCURRENCES
IN THE NAVAL NUCLEAR PROPULSION PROGRAM

Year	Number of Abnormal Occurrences*
1975	0
1976	0
1977	0
1978	0
1979	0
1980	0
1981	0
1982	0

*Abnormal occurrences are reported here if the Navy evaluation determines they meet either the Department of Energy criteria for Type A radiation exposure incidents or the Nuclear Regulatory Commission criteria for quarterly report to Congress as abnormal radiation exposure occurrences.

The policy of the Navy is to provide for close cooperation and effective communication with state radiological officials involving occurrences that might cause concern because of radiological effects associated with the ships or shore facilities. The Navy has reviewed radiological matters with state radiological officials in the states where Naval nuclear-powered ships are based or overhauled. Although there were no recent occurrences which resulted in radiological effects to the public outside these facilities or which resulted in radiological injury to residents of the states working inside these facilities, states were notified when inquiries showed public interest in the possibility such events had occurred.

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ENVIRONMENTAL MONITORING AND DISPOSAL OF RADIOACTIVE WASTES FROM U.S. NAVAL NUCLEAR-POWERED SHIPS AND THEIR SUPPORT FACILITIES

REPORT NT-83-1—FEBRUARY 1983

ABSTRACT

The environmental effect of disposal of radioactive wastes originating from U. S. Naval nuclear propulsion plants and their support facilities is assessed. The total gamma radioactivity in liquids, less tritium, discharged to all ports and harbors from the more than one hundred Naval nuclear-powered ships and supporting tenders, Naval bases and shipyards was less than 0.002 curie in 1982. This report confirms that procedures used by the Navy to control releases of radioactivity from U. S. Naval nuclear-powered ships and their support facilities are effective in protecting the environment and the health and safety of the general public.

SUMMARY

The radioactivity in wastes discussed in this report originates in the pressurized water reactors of U. S. Naval nuclear-powered ships. As of the end of 1982, the U. S. Navy had 124 nuclear-powered submarines and thirteen nuclear-powered surface ships in operation. Support facilities involved in construction, maintenance, overhaul and refueling of these nuclear propulsion plants include nine shipyards, seventeen tenders and three submarine bases. This report describes disposal of radioactive liquid wastes, transportation and disposal of solid wastes, and monitoring of the environment to determine the effect of radioactive releases, and updates reports on this subject issued by the Navy in references 1 through 17.* This report concludes that radioactivity associated with U. S. Naval nuclear-powered ships has had no significant or discernable effect on the quality of the environment. A summary of the radiological information supporting this conclusion follows:

From the start of the Naval nuclear propulsion program, the policy of the U. S. Navy has been to reduce to the minimum practicable the amounts of radioactivity released into harbors. Navy procedures to accomplish this have been reviewed with the U. S. Department of Energy, the U. S. Nuclear Regulatory Commission and the U. S. Environmental Protection Agency. The total gamma radioactivity released within twelve miles from shore from all U. S. Naval nuclear-powered ships and their support facilities in recent years is shown in Table 1; this includes all harbors both U. S. and foreign entered by these ships.

TABLE 1 RADIOACTIVE LIQUID WASTE RELEASED TO HARBORS FROM U. S. NAVAL NUCLEAR-POWERED SHIPS AND THEIR SUPPORT FACILITIES

Year	Number of Ships In Operation	Radioactivity-Curies (less tritium)
1971	100	less than 0.002
1972	104	less than 0.002
1973	107	less than 0.002
1974	111	less than 0.002
1975	113	less than 0.002
1976	115	less than 0.002
1977	120	less than 0.002
1978	124	less than 0.002
1979	126	less than 0.002
1980	126	less than 0.002
1981	133	less than 0.002
1982	137	less than 0.002

As a measure of the significance of these data, if one person were able to drink the entire amount of radioactivity discharged into any harbor in any of the last twelve years, he would not exceed the annual radiation exposure permitted for an individual worker by the U. S. Nuclear Regulatory Commission.

Environmental monitoring is conducted by the U. S. Navy in U. S. and foreign harbors frequented by U. S. Naval nuclear-powered ships. This monitoring consists of analyzing harbor water, sediment and marine life samples for radioactivity associated with Naval nuclear propulsion plants, radiation monitoring around the perimeter of support facilities and effluent monitoring. Environmental samples from each of these harbors are also checked at least annually by a U. S. Department of Energy laboratory to ensure analytical procedures are correct and standardized. The U. S. Environmental Protection Agency has conducted independent surveys in U. S. harbors; results have been consistent with Navy results. These surveys have confirmed that U. S. Naval nuclear-powered ships and support facilities have had no significant effect on the radioactivity of the marine environment.

RADIOACTIVE LIQUID WASTE PROCESSING AND CONTROL

Policy and Procedures Minimizing Release of Radioactivity in Harbors

The policy of the U. S. Navy is to reduce to the minimum practicable the amounts of radioactivity released to the environment, particularly within twelve miles from shore including into harbors. This policy is consistent with applicable recommendations issued by the Federal Radiation Council (incorporated in Environmental Protection Agency in 1970), U. S. Nuclear Regulatory Commission, National Council on Radiation Protection and Measurements, International Commission on Radiological Protection, International Atomic

Energy Agency, and National Academy of Sciences--National Research Council (references 18 through 26). Keeping releases small minimizes the radioactivity available to build up in the environment or to concentrate in marine life. To implement this policy of minimizing releases, the Navy has issued standard instructions defining the radioactive waste disposal limits and procedures to be used by U. S. Naval nuclear-powered ships and their support facilities. These instructions were reviewed by the U. S. Department of Energy, the U. S. Nuclear Regulatory Commission and the U. S. Environmental Protection Agency.

Source of Radioactivity

In the shipboard reactors, pressurized water circulating through the reactor core picks up the heat of nuclear reaction. The reactor cooling water circulates through a closed piping system to heat exchangers which transfer the heat to water in a secondary steam system isolated from the primary cooling water. The steam is then used as the source of power for the propulsion plant as well as for auxiliary machinery. Releases from the shipboard reactors occur primarily when reactor coolant water expands as a result of being heated to operating temperature; this coolant passes through a purification system ion exchange resin bed prior to being transferred from the ship.

The principal source of radioactivity in liquid wastes is from trace amounts of corrosion and wear products from reactor plant metal surfaces in contact with reactor cooling water. Radionuclides with half-lives greater than one day in these corrosion and wear products include tungsten 187, chromium 51, hafnium 181, iron 59, iron 55, nickel 63, zirconium 95, tantalum 182, manganese 54, cobalt 58, and cobalt 60. The most predominant of these is cobalt 60, which has a 5.3 year half-life. Cobalt 60 also has the most restrictive concentration limit in water as listed by organizations which set radiological standards in references 18, 19, and 20 for these corrosion and wear radionuclides. Therefore, radioactive waste disposal is conservatively controlled by assuming that all the long-lived radioactivity is cobalt 60.

Radioactivity Removal From Liquid Wastes at Shore Facilities

Radioactive liquid wastes at shore facilities are collected in stainless steel tanks and processed through a processing system to remove most of the radioactivity (exclusive of tritium) prior to collection in a clean tank for reuse. Even after processing to approximately 10^{-8} microcuries of gamma radioactivity per milliliter, reactor coolant is reused rather than discharged. Figure 1 shows a simplified block diagram of the waste processing system which consists of particulate filters, activated carbon bed filters, mixed hydrogen hydroxyl resin and colloid removal resin beds. This type of processing system has been developed and used successfully to produce high quality water containing very low radioactivity levels.

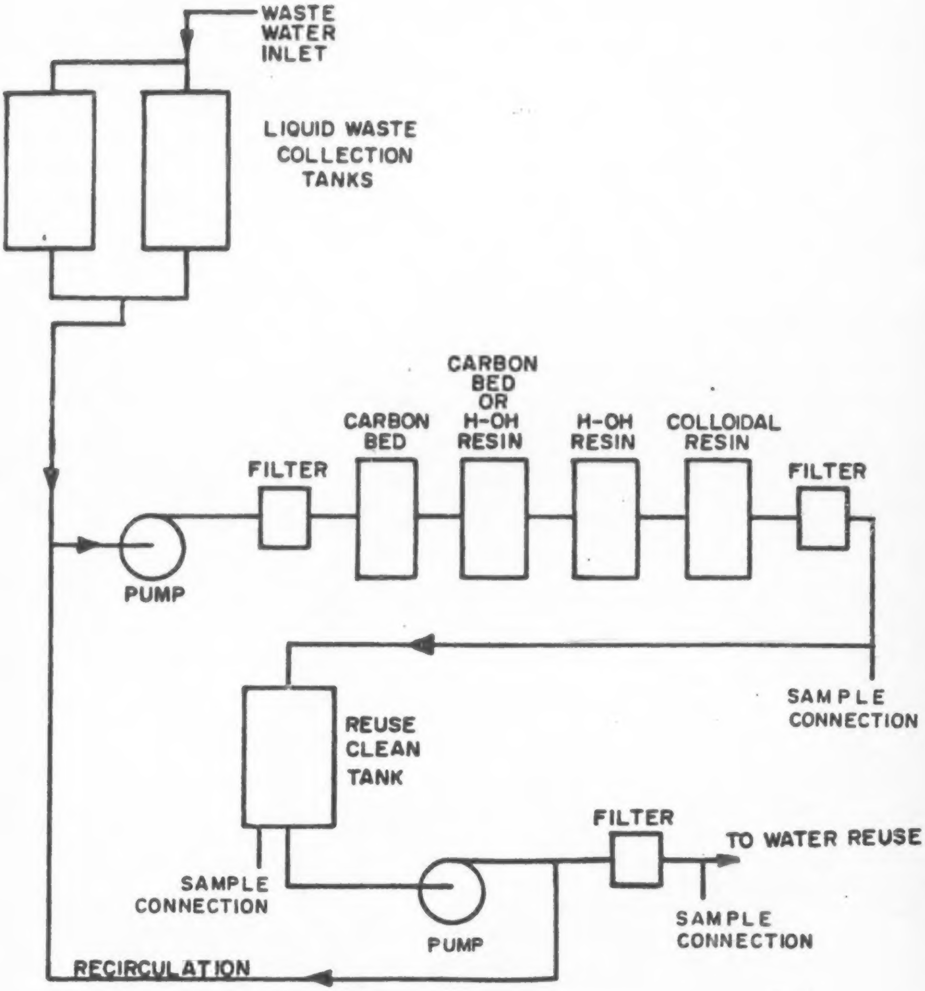
WASTE
WATER
INLET
LIQUID WASTE
COLLECTION
TANKS
CARBON
BED
OR
H-OH
RESIN
CARBON
BED
H-OH
RESIN
COLLOIDAL
RESIN
FILTER
FILTER
PUMP
SAMPLE
CONNECTION
REUSE
CLEAN
TANK
FILTER
TO WATER REUSE
SAMPLE
CONNECTION
PUMP
SAMPLE
CONNECTION
RECIRCULATION

FIGURE 1
SIMPLIFIED DIAGRAM OF WASTE PROCESSING
SYSTEM

Liquid Waste Releases in Harbors

The total amounts of long-lived gamma radioactivity released into harbors and seas within twelve miles from shore have been less than 0.002 curie during each of the last twelve years. This total is for releases from U. S. Naval nuclear-powered ships and from the supporting shipyards, tenders and submarine bases, and at operating bases and home ports in the U. S. and overseas and all other U. S. and foreign ports which were visited by Naval nuclear-powered ships. This quantity is conservatively reported as if it consisted entirely of cobalt 60, which is the predominant long-lived gamma radionuclide and also has the most stringent concentration limits.

To put this small quantity of radioactivity into perspective, it is less than the quantity of naturally occurring radioactivity (reference 27) in the volume of saline harbor water occupied by a single nuclear-powered submarine.

Although volumes are of less significance than the amounts of radioactivity released, Table 1 of earlier reports has also shown that the total volume of liquids released within twelve miles from shore has been reduced from millions of gallons per year in the 1960's to less than 25 thousand gallons per year beginning in 1973. Thus, the Navy has achieved its policy of reducing releases of radioactive liquids in harbors to the minimum practicable amounts. Therefore, volumes have been deleted from this report.

Short-Lived Radionuclides

Reactor coolant also contains short-lived radionuclides with half-lives of seconds to hours. Their highest concentrations in reactor coolant are from nitrogen 16 (7 second half-life), nitrogen 13 (10 minute half-life), fluorine 18 (1.8 hour half-life), argon 41 (1.8 hour half-life) and manganese 56 (2.6 hour half-life). Total short-lived radioactivity released in water in a year to any harbor has been less than 0.001 curie. For the longest-lived of these, about one day after discharge from an operating reactor, the concentration is reduced to one thousandth of the initial concentration, and in about two days the concentration is reduced to one millionth. Therefore, since most of the water is transferred to shore facilities for processing and reuse rather than discharged, these short-lived radionuclides are not important for water disposal considerations.

Fission Product Radionuclides

Fission products produced in the reactor are retained within the fuel elements. The fission gases krypton and xenon are also retained within the fuel elements. However, trace quantities of naturally occurring uranium impurities in reactor structural materials release small amounts of fission products to reactor coolant. The concentrations of fission products and the volumes of reactor coolant released are so low, however, that the total radioactivity attributed to long-lived fission product radionuclides, strontium 90 and cesium 137, in releases from U. S. Naval nuclear-powered ships and their support facilities has been less than 0.001 curie per year for all harbors combined. Fallout of these same fission products has often been more than this in one rainfall in a single harbor.

Tritium

Small amounts of tritium are formed in reactor coolant systems as a result of neutron interaction with the approximately 0.015 percent of naturally occurring deuterium present in water, and other nuclear reactions. Although tritium has a 12 year half-life, the radiation produced is of such low energy that the radioactivity concentration guide issued by the International Commission on Radiological Protection, the National Council on Radiation Protection and Measurements, the U. S. Nuclear Regulatory Commission and by other standard-setting organizations is one hundred times higher for tritium than for cobalt 60. This tritium is in the oxide form and is chemically indistinguishable from water; therefore, it does not concentrate significantly in marine life or collect on sediment as do other radionuclides.

Tritium is naturally present in the environment because it is generated by cosmic radiation in the upper atmosphere. Reference 28 reports that the production rate from this source is about six million curies per year, which through rainfall causes a tritium inventory in the oceans of about one hundred million curies. Because of this naturally occurring tritium, much larger releases of tritium than are conceivable from Naval nuclear reactors would be required to make a measurable change in the background tritium concentration.

The total amount of tritium released during each of the last thirteen years from all U. S. Naval nuclear-powered ships and their supporting tenders, bases and shipyards has been less than 200 curies. Most of this has been into the ocean greater than tweleve miles from shore. The total tritium released from the entire nuclear Navy is less than single electrical generating nuclear power stations typically release each year (reference 29). Total tritium released into harbors within twelve miles from shore was less than one curie in 1982. Such releases are too small to increase measurably the tritium concentration in the environment. Therefore, tritium has not been combined with the data on other radionuclides in other sections of this report.

Carbon 14

Carbon 14 is also formed in small quantities in reactor coolant systems as a result of neutron interactions with nitrogen and oxygen. Carbon 14 decays with a half-life of 5,730 years; however, only low energy beta radiation is emitted as a result of this decay process. As a result, the radioactivity concentration guide for carbon 14 in its chemical form in air issued by the International Commission on Radiological Protection, the National Council on

Radiation Protection and Measurements, the U. S. Nuclear Regulatory Commission and by other standard-setting organizations is three thousand times higher than for cobalt 60.

Carbon 14 occurs naturally in the environment. It is generated from cosmic radiation interactions with nitrogen and oxygen in the upper atmosphere and oxidized to form carbon dioxide. Carbon 14 is chemically indistinguishable from other isotopes of carbon. The carbon dioxide diffuses and convects throughout the atmosphere and enters the earth's carbon cycle. Reference 30 states that the earth's carbon 14 inventory is estimated to be about three hundred and ten million curies. The total amount of carbon 14 released during each of the last fourteen years from the operation of all U. S. Naval nuclear-powered ships and their supporting tenders, bases and shipyards has been less than 100 curies, most of which is released into the atmosphere at sea beyond twelve miles from shore. The total carbon 14 radioactivity released in a year in any harbor has been less than 0.1 curie. Since the inventory of naturally occurring carbon 14 is so large, it is extremely unlikely that releases from Naval nuclear reactors could result in a measureable change in the background concentration of carbon 14. Therefore, carbon 14 has not been combined with the data on other radionuclides in other sections of this report.

Liquid Waste Releases at Sea

Radioactive liquids incidental to the operation of the nuclear propulsion plants are released at sea under strict controls. These ocean releases are consistent with recommendations the Council on Environmental Quality made in 1970 to the President in reference 31, and consistent with the Marine Protection, Research and Sanctuaries Act, reference 32. Procedures and limits for ocean releases have been consistent with recommendations made by the National Academy of Sciencies--National Research Council in reference 22 and by the International Atomic Energy Agency in reference 23. These releases have contained much less radioactivity than these reports considered would be acceptable. Total long-lived radioactivity excluding tritium released farther than twelve miles from shore by U. S. Naval nuclear-powered ships and supporting tenders is shown in Table 2 for recent years. This is the total amount released from over 100 ships at different times of the year in the open sea at long distances from land in small incremental amounts, and under rapid dispersal conditions due to wave action. The quantity of radioactivity released to the open ocean in 1982 was 0.4 curie, which is less than the naturally occurring radioactivity in a cube of sea water approximately 100 yards on a side.

TABLE 2 TOTAL RADIOACTIVITY IN LIQUID WASTE RELEASED AT SEA ORIGINATING FROM U. S. NAVAL NUCLEAR-POWERED SHIPS

	Radioactivity-Curies (less tritium)
1974	0.4
1975	0.4
1976	0.4
1977	0.4
1978	0.4
1979	0.4
1980	0.4
1981	0.4
1982	0.4

Loss of USS THRESHER and USS SCORPION

Two U. S. Naval nuclear-powered submarines have been lost at sea in the Atlantic Ocean. The submarine THRESHER sank 10 April 1963, 100 miles from land in water 8,500 feet deep at latitude 41°45'N and longitude 65°00'W. The submarine SCORPION sank between 21 and 27 May 1968, 400 miles southwest of the Azores in more than 10,000 feet of water. The reactors used in all U. S. Naval submarines and surface ships are designed to minimize potential hazards to the environment even under the most severe casualty conditions such as actual sinking of the ship. First, the reactor core is so designed that it is physically impossible for it to explode like a bomb. Second, the reactor fuel elements are made of materials that are extremely corrosion resistant, even in sea water. The reactor core could remain submerged in sea water for decades without releases of fission products while the radioactivity decays, since the protective cladding on the fuel elements corrodes only a few millionths of an inch per year. Thus, in the event of a serious accident where the reactor is completely submerged in sea water, the fuel elements will remain intact for an indefinite period of time, and the radioactive material contained in these fuel elements should not be released. The maximum rate of release and dispersal of the radioactivity in the ocean, even if the protective cladding on the fuel were destroyed, would be so low as to be insignificant.

Radioactive material could be released from this type of reactor only if the fuel elements were actually to melt and, in addition, the high-strength, all-welded reactor system boundary were to rupture. The reactor's many protective devices and inherent self-regulating features are designed to prevent any melting of the fuel elements. Flooding of a reactor with sea water furnishes additional cooling for the fuel elements and so provides added protection against the release of radioactive fission products.

Radiation measurements, water samples, bottom sediment samples and debris collected from the area where THRESHER sank were analyzed for radioactivity shortly after the sinking and again in 1965 by various laboratories with highly sensitive equipment. Similarly, sea water and bottom sediment samples taken near SCORPION's hull were analyzed for radioactivity. None of these samples showed radioactivity above naturally occurring background levels, and none showed evidence of radioactivity released from either THRESHER or SCORPION.

In 1977, followup samples of water, sediment, marine life and debris were collected from the immediate THRESHER debris areas. In 1979, followup samples of water, sediment, marine life and debris were collected from the immediate SCORPION debris areas. None of these samples showed any evidence of release of radioactivity from the reactor fuel elements in either THRESHER or SCORPION. However, cobalt 60 released from both THRESHER and SCORPION coolant systems was detectable at low levels in sediment samples in the debris areas. The amount of cobalt 60 radioactivity in these samples was small compared to the naturally occurring radioactivity in the sediments. Based on the samples, less than 0.001 curie of cobalt 60 was estimated to be present in the sediment at either site. Cobalt 60 was not detectable in samples of water, marine life or debris. Thus, the THRESHER and SCORPION have not had a significant effect on the radioactivity in the environment. Additional information on the radiological surveys of the THRESHER and SCORPION debris areas is available in reference 33.

SOLID RADIOACTIVE WASTE DISPOSAL

During maintenance and overhaul operations, solid low-level radioactive wastes consisting of contaminated rags, plastic bags, paper, filters, ion exchange resin and scrap materials are collected by nuclear-powered ships and their support facilities. These low level radioactive materials from nuclear-powered ships are required to be strictly controlled to prevent loss. These controls include Naval accountability procedures which require serialized tagging and marking and signatures by radiologically trained personnel.

Solid radioactive waste materials are packaged in strong tight containers, shielded as necessary and shipped to burial sites licensed by the U. S. Nuclear Regulatory Commission or a State under agreement with the U. S. Nuclear Regulatory Commission. Solid radioactive materials from Naval nuclear-powered ships have not been dumped at sea since 1970 when the Navy issued procedures prohibiting sea disposal of solid radioactive materials. Shipyards and other shore facilities are not permitted to dispose of radioactive solid wastes by burial on their own sites.

Table 3 summarizes the total radioactivity and volumes of radioactive solid waste disposal for the last five years. Table 3 includes all waste generated by U. S. Naval nuclear-powered ships and the listed support facilities since all radioactive solid waste generated by U. S. nuclear-powered ships is transferred to the listed facilities. The quantity of solid radioactive waste in any one year from a particular facility depends on the amount and type of support work performed that year. Table 3 does not include expended fuel or radioactive material associated with expended fuel since expended fuel is shipped from the refueling shipyard by the Department of Energy to its facilities in Idaho for processing in the same manner as other expended nuclear fuel.

TABLE 3 RADIOACTIVE SOLID WASTE FROM U. S. NAVAL NUCLEAR-POWERED SHIPS AND THEIR SUPPORT FACILITIES FOR 1978 THROUGH 1982.

Facility	1978 Thousand Cubic Feet	1978 Curies	1979 Thousand Cubic Feet	1979 Curies	1980 Thousand Cubic Feet	1980 Curies	1981 Thousand Cubic Feet	1981 Curies	1982 Thousand Cubic Feet	1982 Curies
Kittery, Maine Portsmouth Naval Shipyard	6	2	3	3	2	3	3	9	1	<1
Groton, New London, Conn. Electric Boat Division., Tender at State Pier, & Sub Base	3	<1	4	<1	3	<1	1	<1	1	<1
Newport News, Virginia Newport News Shipbuilding	3	15	2	4	1	1	4	12	5	2
Norfolk, Virginia Naval Shipyard and Tenders	4	2	2	5	2	4	5	7	3	<1
Charleston, South Carolina Naval Shipyard and Tenders	7	17	3	5	3	3	2	3	3	12
Pascagoula, Mississippi Ingalls Shipbuilding Div.	2	1	1	<1	1	<1	3	<1		
San Diego, California Tenders	1	<1	1	<1	1	<1	1	<1	1	<1
Vallejo, California Mare Island Naval Shipyard	11	18	2	22	6	36	2	16	2	6
Bremerton, Washington Puget Sound Naval Shipyard & Sub Base	7	5	7	3	5	21	7	11	6	32
Pearl Harbor, Hawaii Naval Shipyard & Sub Base	4	12	2	2	2	18	2	1	2	17
TOTAL	48	72	27	44	26	86	30	59	24	69

NOTES:

(1) This table includes all radioactive waste from tenders and nuclear-powered ships. This radioactivity is primarily cobalt 60. This radioactive waste is shipped to burial facilities licensed by the U. S. Nuclear Regulatory Commission or State.

(2) Volumes less than 500 cubic feet are reported <1 thousand and less than 0.5 curie is reported 1.

(3) The total volumes include 4000 cubic feet generated in 1979 and 1980 that were not shipped for disposal until 1981 due to temporary unavailability of burial facilities.

(4) The total volume for 1982 includes 5000 cubic feet that were generated but not shipped for disposal in 1982.

Figure 2 shows that in the last ten years the total annual volume of solid low-level radioactive waste has been reduced by a factor of five despite increasing numbers of ships. Most of the volume is generated during maintenance and overhaul operations in shipyards. This reduction has been accomplished simultaneously with reduction in personnel radiation exposure, as described in reference 34. This reduction has been accomplished by several techniques including a total containment concept for radiological work which minimizes the spread of radioactivity to non-radioactive materials, use of preplanning and mockups to minimize rework, reusing rather than disposing of tools and equipment, segregation of radioactive materials from other materials, use of liquid waste processing procedures which minimize depletion of processing media, and use of compaction equipment and efficient packaging to fully use space in disposal containers. Challenging goals are set by each shipyard to ensure continuing management attention to minimizing generation of waste in radiological work.

The annual volume for the entire Naval nuclear propulsion program could be contained in a cube measuring ten yards on a side. The total annual volume of solid radioactive waste from the Naval nuclear propulsion program listed in Table 3 is less than some individual electrical generating nuclear power stations generate annually (reference 29). The total annual volume is approximately two percent of the solid radioactive waste generated annually by all nuclear electric power reactors (reference 29) and less than one percent of the total volume of radioactive solid waste buried in all U. S. commercial burial grounds each year (reference 35).

Deactivation of Ingalls Shipbuilding Radiological Facilities

From 1958 to 1980, Ingalls Shipbuilding was engaged in the construction and overhaul of Naval nuclear-powered ships in Pascagoula, Mississippi. The shipyard radiological facilities which supported this work were deactivated between 1980 and 1982 by removing and disposing of all radioactive material associated with Naval nuclear propulsion plants. Useful items, such as tools and equipment that were radioactively contaminated, were transferred to other organizations in the Naval Nuclear Propulsion Program. The remaining radioactive material was disposed of as solid radioactive waste.

Extensive radiological decommissioning surveys were performed to verify the removal of this radioactive material. Direct radiological surveys were performed on over 274,000 square feet of building and facility surfaces. Over 11,000 samples of these surfaces as well as soil, ground cover, and concrete were taken from all areas where radioactive work was previously performed. These samples were analyzed using sensitive laboratory equipment. In addition, both the State of Mississippi and the Environmental Protection Agency performed overcheck surveys of the deactivated facilities. After these surveys were completed, the Ingalls facilities were released for unrestricted use. Personnel who subsequently occupy these

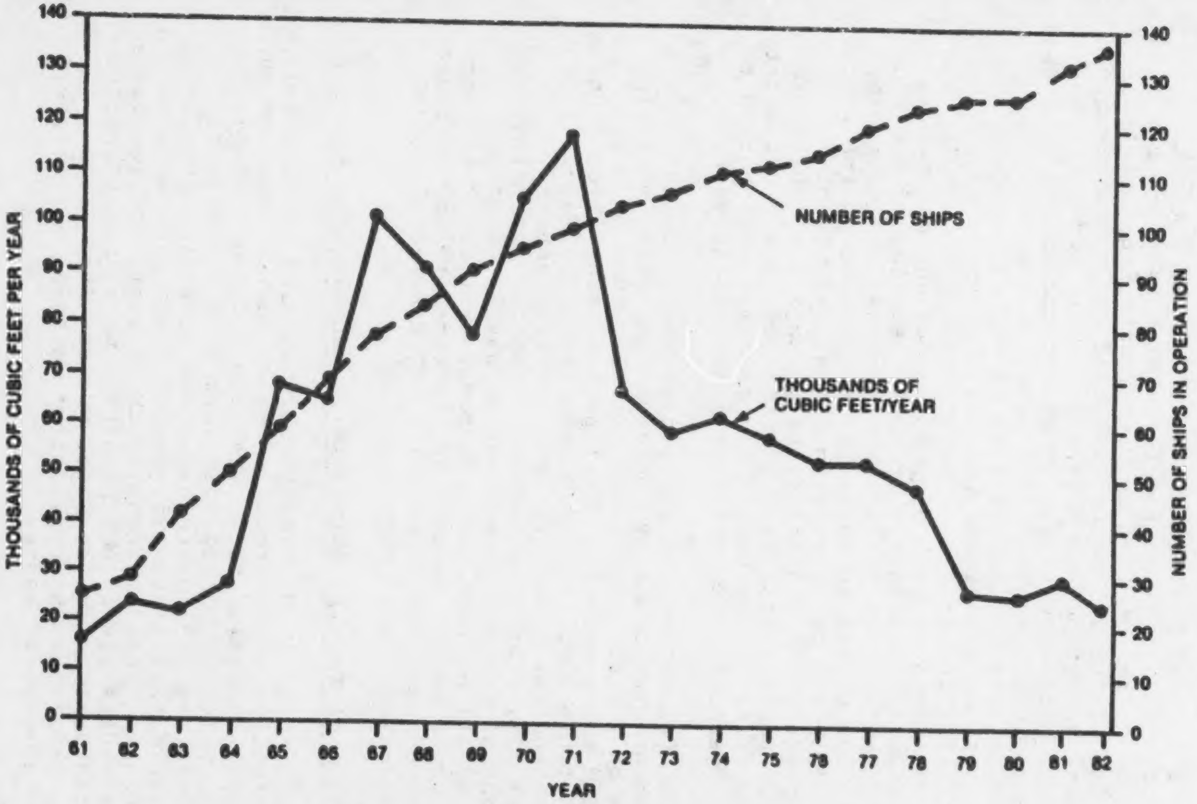

FIGURE 2

RADIOACTIVE SOLID WASTE DISPOSAL VOLUMES IN THE NAVAL NUCLEAR PROPULSION PROGRAM, 1961-1982 facilities will not receive any measurable radiation exposure above natural background levels that exist in areas not affected by Naval nuclear propulsion plant work.

TRANSPORTATION OF RADIOACTIVE MATERIAL

Shipments of radioactive materials in the Naval nuclear propulsion program are required to be made in accordance with regulations of the U. S. Department of Transportation, U. S. Department of Energy, and U. S. Nuclear Regulatory Commission. The purpose of these regulations is to ensure that shipments of radioactive material are adequately controlled to protect the environment and the health and safety of the general public. These regulations are applicable to all radioactive material shipments including waste. The shipments discussed herein cover areas in addition to waste for completeness.

The above regulations provide requirements for the container design, certification, and identification as applicable for the specific quantity, type and form of radioactivity being shipped. Naval shipping container design requirements invoke shielding and integrity specifications and meet all regulatory requirements. They provide for testing of container designs, training and qualification of workers who construct containers, and quality control inspections during fabrication to ensure the containers will meet their design requirements.

In addition to imposing requirements of Federal transportation regulations, the Navy has issued standard instructions to further control shipments of radioactivity associated with U. S. Naval nuclear propulsion plants. These standard instructions result in a quality assurance program which includes inspections and assessments by independent organizations and senior management. Organizations making shipments are required to prepare local procedures which require use of compliance checklists and management review to ensure compliance with applicable Department of Transportation, Navy, and burial ground requirements. Only specially trained, designated people, knowledgeable in shipping regulations, are permitted to authorize shipments of radioactive material.

Protective transportation service such as signature security service or sealed shipping vehicles are required for these shipments to ensure point-to-point control and traceability of each shipment from shipper to receiver. A readily accessible log of all shipments in transit is maintained to enable prompt identification and provide the basis for advice on the nature of the shipment. Return receipts are required to be made in writing by receivers to ensure that radioactive material has not been lost in shipment. Receipt inspection of containers of radioactive material and accompanying documents are required promptly after receipt to monitor compliance. Even minor discrepancies from detailed shipping regulations are required to be reported to the shipper so that correction can be made in future shipments. This is done to ensure compliance with shipping regulations.

Radioactive materials shipped in the Naval nuclear propulsion program include anticontamination clothing for laundry, small sealed sources used for calibrating radiation monitoring instruments, tools and equipment used for radioactive work, low-level radioactive waste, radioactive components and new and spent nuclear fuel. A total of approximately 1,000 shipments are made annually by Naval nuclear-powered ships and their support facilities, which is a small part of the approximately two million shipments of radioactive materials made annually in the United States (Reference 36).

Nearly all radioactive shipments in the Naval nuclear propulsion program contain only low-level radioactivity classified under Department of Transportation regulations as low specific activity or limited quantity shipments. The predominant radionuclide associated with these shipments is cobalt 60 in the form of insoluble metallic oxide corrosion products attached to surfaces of materials inside shipping containers. Most low-level shipments are made by truck. Air transport is used no more than a few times per year for the Naval nuclear propulsion program. These air shipments involve only very low-level radioactivity and are not shipped on passenger planes.

Nearly one-quarter of the low-level radioactivity shipments are minute quantities in sealed instrument calibration check sources. These sources contain insignificant quantities of radioctivity which are comparable to the radioactivity in typical ionization type smoke detectors. Approximately 65 percent of the shipments are anticontamination clothing, equipment and tools. The anticontamination laundry involves shipments of special outer clothing potentially contaminated with low-levels of radioactivity while worn in controlled work areas. This laundry is shipped by Nuclear Regulatory Commission licensed contractors to their facilities for cleaning. On the average, one shipment of low-level radioactive waste per three months is made from each facility listed in Table 3.

The remaining few shipments are new and spent nuclear fuel and radioactive components associated with spent nuclear fuel and are shipped by the U. S. Department of Energy. Such shipments are made infrequently since U. S. Naval nuclear-powered ships need refueling infrequently. Spent nuclear fuel shipments are made to Department of Energy facilities for disposition. Measures are carried out to assist in safeguarding these shipments and assuring they reach their destination. Each spent fuel shipment is escorted by U. S. Government representatives and each shipping container is specifically designed to withstand extreme accident impacts, fire, or water immersion, and to prevent release of the material to the environment in the event of an accident. The cargo in the nuclear fuel and radioactive component shipments is non-explosive and non-flammable and, in addition, the radioactive material in the radioactive components is in an insoluble form that should not be dispersed even in the event of an accident.

Estimates of radiation exposure to transportation crews and the general public from shipments of radioactive materials in the Naval nuclear propulsion program have been made in a manner consistent with that employed by the U. S. Nuclear Regulatory Commission in reference 36. Based on comparisons of the types and numbers of radioactive shipments made, the total annual radiation exposure to all transportation crews for all shipments is estimated to be less than three man-rem. If one person were to receive all this exposure, he would not exceed the radiation exposure permitted for an individual worker by the U. S. Nuclear Regulatory Commission. The total estimated radiation exposure accumulated by the public along transportation routes is not more than a few times higher than the exposure to transportation workers. The maximum exposure to any individual member of the public would be far less than received from natural radiation.

Shipments of radioactive materials associated with Naval nuclear propulsion plants have not resulted in any measurable release of radioactivity to the environment. There have never been any significant accidents involving release of radioactive material during shipment since the Naval nuclear propulsion program began. In general, the few accidents that have occurred involved incidents such as broken truck axles or slight external damage to a shipping container with no release of radioactivity. In one incident a train collision resulted in minor denting of a new fuel shipping container with no loss of integrity of the container, no damage to the fuel and no release of radioactivity. In the only two instances that involved loss of contents, one quart containers holding samples were broken in shipment. In one case this occurred when a cargo aircraft crashed. The other container was lost from a commercial ship. Both containers were recovered and there was no measurable radioactivity released since the original contents were less than one millionth of a curie, too small to be measurable in the environment.

The requirements of the Naval nuclear propulsion program specify that the carriers for all radioactive material shipments shall have accident plans which identify the actions to be taken in the event the transportation vehicle is involved in an accident. These plans provide for notification of civil authorities and the originating facility. The U. S. Navy would communicate with and cooperate fully with State radiological officials in the event of occurrences involving shipment of radioactive materials.

ENVIRONMENTAL MONITORING

To provide additional assurance that procedures used by the U. S. Navy to control radioactivity are adequate to protect the environment, the Navy conducts environmental monitoring in harbors frequented by its nuclear-powered ships. Environmental monitoring surveys for radioactivity are periodically performed in harbors where U. S. Naval nuclear-powered ships are built or overhauled and where these ships have home ports or operating bases. Samples from each harbor monitored are also checked at least annually by a U. S. Department of Energy laboratory to ensure analytical procedures are correct and standardized. The Department of Energy laboratory results have been consistent with shipyard and operating base results.

Navy Environmental Monitoring Program

The current Navy environmental monitoring program consists of analyzing samples of harbor water and sediment, supplemented by shoreline surveys, posted dosimeters and effluent monitoring. Sampling harbor water and sediment each quarter year is emphasized since these materials would be the most likely affected by releases of radioactivity. Marine life samples have also been collected from some harbors.

At least five water samples are taken in each harbor once each quarter year in areas where nuclear-powered ships berth and from upstream and downstream locations. These samples are analyzed for gross gamma radioactivity and for cobalt 60 content. A solid state lithium-drifted germanium detector with a multichannel analyzer is used to measure gross gamma radioactivity in an energy range from 0.1 MeV to 2.1 MeV expressed in terms of cobalt 60 equivalent and to analyze the resulting gamma data for the presence of cobalt 60. Procedures for analysis will detect cobalt 60 if its concentration exceeds the U. S. Environmental Protection Agency drinking water limits of reference 26. No cobalt 60 has been detected in any of the water samples from all harbors monitored.

A radiological laboratory of the Environmental Protection Agency has analyzed samples from harbors to identify radionuclides present in sediment. These analyses showed cobalt 60 was the predominant radionuclide added to sediment from Naval nuclear reactor operations. Therefore, Navy monitoring procedures require collecting in each harbor approximately 20 to 120 sediment samples once each quarter year for cobalt 60 and gross gamma analyses. Locations and numbers of sediment samples for a particular harbor depend on the size of the harbor and the number and separation of locations where nuclear-powered ships berth. Sampling points are selected to form a pattern around ship berthing locations and to provide points in areas away from these berthing locations. The sampling locations are selected individually for each harbor considering characteristics of the harbor. Sediment samples are collected using the dredge. The dredge samples a surface area of 36 square inches and has been modified to collect only the top one-half to one inch of sediment. The top layer was selected because it should be more mobile and more accessible to marine life than deeper layers. After the dredge is lowered to the harbor bottom, the messenger weight is lowered on the support line from the surface and causes the spring-loaded jaws on the dredge to close and trap the sediment. The samples are placed directly into a Marinelli container for analysis. Each sediment sample is analyzed for gamma radioactivity in the container in which it is collected using the lithium-drifted germanium detector with a multichannel analyzer. The sediment samples are not dried prior to analysis but excess water is drained off. Gross gamma radioactivity in an energy range from 0.1 MeV to 2.1 MeV is expressed in terms of equivalent cobalt 60 and the resulting gamma data is analyzed for the presence of cobalt 60 radioactivity. Results of the sediment samples from harbors monitored by the Navy in the U. S. and possessions for 1982 are summarized in Table 4.

Evaluation of the data summarized in Table 4 shows that low-level cobalt 60 radioactivity in harbor bottom sediment is detected around a few operating base and shipyard piers where nuclear-powered ship maintenance and overhauls have been conducted over a period of several years. The radioactivity detected is from operations in the early 1960's since releases such as shown earlier in Table 1 are too small to be detectable in the harbors. Cobalt 60 is not detectable above background levels in general harbor bottom areas away from these piers. Maximum total radioactivity observed in a U. S. harbor is less than 0.05 curie of cobalt 60. This radioactivity is small compared to background. Based on the typical concentrations of naturally occuring radioactivity such as potassium 40, radium, uranium and thorium which are described in reference 27 for marine sediment, the natural radioactivity in the sediment of a typical harbor amounts to hundreds of curies. Comparison to previous environmental monitoring data in references 1 through 17 shows that these environmental cobalt 60 levels have been steadily decreasing.

The first data column in Table 4 includes all samples with less than 3 millionths of a microcurie of cobalt 60 per gram of sediment. Most of the sediment samples did not contain detectable cobalt 60 and all of them are tabulated in this range. In this range cobalt 60 is comparable to the levels of naturally occurring radioactivity such as potassium, radium, uranium and thorium. Cobalt 60 in sediment in this low range may also be detectable as a result of world wide dispersion from atmospheric nuclear weapons testing.

The value of 30 millionths of a microcuries per gram was selected for the top of the second range of data in Table 4. A measure of the significance of this range is that if all a person's food were to contain cobalt 60 in this range of radioactivity throughout the year, he would not exceed radiation exposure levels permitted in references 18, 19, and 20 for members of the general public. None of the sediment samples are in this second range, and none of the samples exceeded this range in 1982. Data on uptake of this cobalt 60 by marine life obtained to date show that in the salt water harbor bottom environments, no significant buildup of cobalt 60 occurs in marine life. An Environmental Protection Agency evaluation in reference 37 shows that the cobalt 60 from Naval nuclear propulsion plants is in the form of metallic corrosion product particles which do not appear to be concentrated in the food chain. Because of the nature of the radioactivity and the low concentrations noted in Table 4, extensive monitoring of radioactivity in marine life has not been necessary as part of routine environmental monitoring programs in these harbors.

TABLE 4 SUMMARY OF 1982 SURVEYS FOR COBALT 60 in BOTTOM SEDIMENT OF U. S. HARBORS WHERE U. S. NAVAL NUCLEAR-POWERED SHIPS HAVE BEEN REGULARLY BASED, OVERHAULED OR BUILT.

	Number of Samples with Cobalt 60			Total Bottom Area with Cobalt 60 over 3×10^{-6} μCi/gm** (Square Kilometers)	Estimated Total *** Cobalt 60 in Top Layer of Sediment (Curies)
	less than $3x10^{-6}$μCi/gm*	3 to 30x 10^{-6}μCi/gm	Greater than 30x 10^{-6}μCi/gm		
Kittery, Maine Portsmouth Naval Shipyard	176	0	0	0	ND
Groton, New London, Conn. Electric Boat Division, State Pier and Sub Base	533	0	0	0	0.01
Newport News, Virginia Newport News Shipbuilding	152	0	0	0	ND
Norfolk, Virginia Naval Shipyard and Base	256	0	0	0	ND
Charleston, South Carolina Naval Shipyard and Bases	208	0	0	0	ND
St. Marys, Georgia	92	0	0	0	ND
San Diego, California Navy Piers	255	0	0	0	ND
Vallejo, California Mare Island Naval Shipyard	228	0	0	0	ND
Bremerton, Washington Naval Shipyard and Base	334	0	0	0	ND
Pearl Harbor, Hawaii Naval Shipyard and Sub Base	184	0	0	0	ND
Apra Harbor, Guam	124	0	0	0	ND
Port Canaveral, Florida	79	0	0	0	ND

NOTE: *Minimum detectable radioactivity is approximately 0.2 millionths of a microcurie per gram.
1μCi = 1 x 10^{-6}μCi

**One square kilometer is approximately equal to 0.4 square mile.

***Where total cobalt 60 in the surface sediment layer is less than 0.01 curie, ND is reported. Samples more than one foot deep from several harbors show that total cobalt 60 present may be two to five times that measured in the surface layer.

In addition to Navy analysis of environmental samples, at least two sediment samples from each harbor monitored have been sent each year to a U. S. Department of Energy laboratory, as a check of Navy results. This Department of Energy laboratory provides a further check on the quality of environmental sample analyses by participating in the quality control programs sponsored by the Department of Energy and the Environmental Protection Agency.

The check samples were analyzed for gamma radionuclides in a manner similar to Navy procedures but with greater sensitivity. Figure 4 depicts the gamma spectra for two such samples. Both spectra show the presence of abundant naturally occurring radionuclides which contribute to measured radioactivity even if cobalt 60 were not present. The upper spectrum is for a sample to which cobalt 60 has been added to a concentration of approximately 3 millionths of a microcurie per gram and shows easily recognizable energy peaks due to the presence of this small concentration of cobalt 60. The lower spectrum depicts the appearance of most of the sediment samples in the first column in Table 4.

In addition to the extensive quarterly monitoring of harbor water and sediment, selected samples of marine life such as mollusks, crustaceans and marine plants have been collected in 1982 from most harbors monitored. Marine life samples are also analyzed using a lithium-drifted germanium detector with a multi-channel analyzer. No buildup of cobalt 60 associated with U. S. Naval nuclear-powered ships has been detected in these samples of marine life.

For comparison, references 38 and 39 contain evaluations by laboratories of the Environmental Protection Agency and of the Department of Energy of the effects on the environment from the accumulation near points of discharge of radionuclides from several nuclear facilities. The referenced reports conclude for these other facilities that radioactivity levels much greater than shown in Table 4 have caused no significant radiation exposure to the general public.

In all monitored harbors, twice per year shoreline areas uncovered at low tide are surveyed for radiation levels with sensitive scintillation detectors to determine if any radioactivity from bottom sediment washed ashore. All results were the same as background radiation levels in these regions, approximately 0.01 millirem per hour. Thus, there is no evidence in these ports that these areas are being affected by nuclear-powered ship operations.

Ambient radiation levels are measured using sensitive thermoluminescent dosimeters continuously posted at locations outside the boundaries of areas where radioactive work is performed. These dosimeters are also posted at locations remote from support facilities to measure background radiation from natural radioactivity. Results of dosimeters posted at support facilities between radiologically controlled areas and the general public are compared with dosimeters posted at remote background locations up to several miles away. These results showed

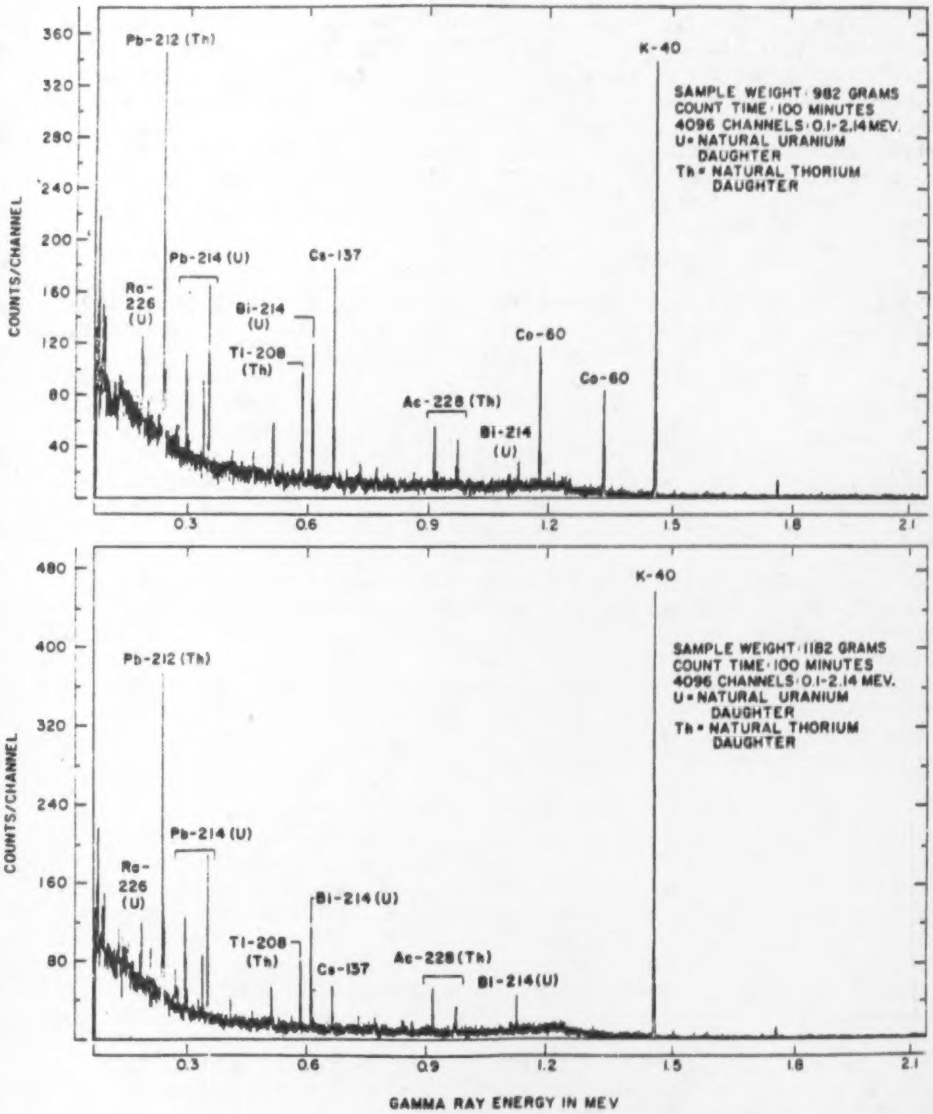

FIGURE 4 GAMMA SPECTRA OF HARBOR BOTTOM SEDIMENT SAMPLES WITH LITHIUM-DRIFTED GERMANIUM DETECTOR

that radiation exposure to the general public from radioactive work on Naval nuclear propulsion plants has not increased above that received from natural background radiation.

Naval nuclear reactors and their support facilities are designed to ensure there are no significant discharges of radioactivity in airborne exhausts. Radiological controls are exercised in support facilities to preclude exposure of working personnel to airborne radioactivity exceeding limits for the general population specified in reference 18. These controls include, a total containment concept for radioactive materials and provide a barrier to prevent significant radioactivity from becoming airborne. Further, all air exhausted from these facilities is passed through high efficiency particulate air filters and monitored during discharge. Comparison of sensitive airborne radioactivity measurements in shipyards demonstrates that air exhausted from facilities actually contained a smaller amount of radioactivity than this same air contained when it was drawn from the environment into the facilities. There were no discharges of airborne radioactivity above concentrations normally present in the atmosphere.

ENVIRONMENTAL PATHWAYS ANALYSIS

Results of monitoring of environmental samples described above have shown that environmental radioactivity levels have not been changed appreciably and therefore radiation exposure to the public from operations of nuclear-powered ships and their support facilities is too low to measure. Nevertheless, a detailed analysis has been performed to provide a quantitative estimate of the radiation exposure to which any member of the general public might be exposed as a result of radioactivity in liquid and airborne effluents.

This analysis has been performed in a conservative manner which ensures that the estimated exposure is higher than any actual exposure would be. For example, the sites chosen for analysis were shipyards since the amount of radiological work at these facilities is considerably higher than at other types of support facilities. Quantities of radioactivity from shipyard releases used in this analysis are higher than have been measured from any shipyard in the last five years. Values of environmental parameters including meteorological conditions and radionuclide concentration factors have been chosen to provide conservative results. In addition, the analysis assumes the individual receiving the maximum exposure is located right at the site boundary. Thus, the actual exposures to members of the public are expected to be lower than the results of this analysis.

The environmental pathways which were considered are depicted in Figure 5, which is based on reference 20. The hypothetical releases assumed are listed in Table 5. Table 6 shows the assumed usage parameters which are based on reference 40. Concentration factors for radionuclides in the marine environment were assumed as published in reference 41 and are also in Table 6. The pathways

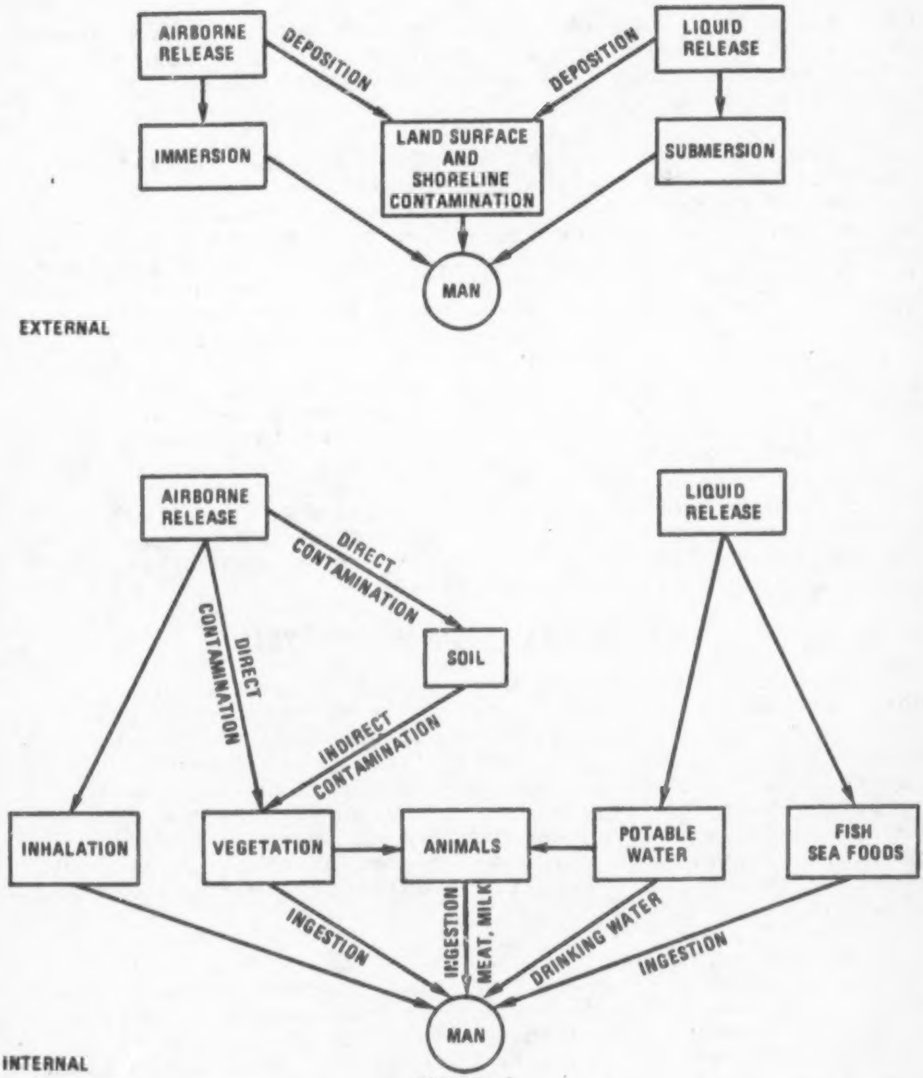
AIRBORNE RELEASE
DEPOSITION
DEPOSITION
LIQUID RELEASE
IMMERSION
LAND SURFACE AND SHORELINE CONTAMINATION
SUBMERSION
MAN
EXTERNAL
AIRBORNE RELEASE
DIRECT CONTAMINATION
LIQUID RELEASE
DIRECT CONTAMINATION
SOIL
INDIRECT CONTAMINATION
INHALATION
VEGETATION
ANIMALS
POTABLE WATER
FISH SEA FOODS
INGESTION
INGESTION
MEAT, MILK
DRINKING WATER
INGESTION
MAN
INTERNAL

FIGURE 5

PATHWAYS FOR EXTERNAL AND INTERNAL EXPOSURE OF MAN FROM AIRBORNE AND LIQUID RELEASES OF RADIOACTIVE EFFLUENTS analysis, including meteorology, population distribution, and radiological exposure rates was performed in a manner consistent with that employed by the U. S. Nuclear Regulatory Commission in reference 40.

Results of the analysis are summarized in Tables 7 and 8. Table 7 compares the estimated maximum exposure to a member of the public with guidelines of the Nuclear Regulatory Commission, although these guidelines are not applicable to nuclear-powered ships and their support facilities. These numerical guidelines on calculated radiation exposures have been issued by the Nuclear Regulatory Commission in reference 25 for implementing the concept that radioactivity in effluents from light water nuclear electric power reactors should be limited to amounts and quantities as low as reasonably achievable. These numerical guidelines of the Nuclear Regulatory Commission are consistent with environmental standards for the uranium nuclear fuel cycle issued by the Environmental Protection Agency in reference 42. Table 8 presents the estimated total whole body radiation exposure to the total population within 50 miles from the assumed radioactivity releases compared with the radiation exposure received by the same population from natural background radioactivity, as reported in references 24, 30 and 43. As shown in Tables 7 and 8, conservative estimates of the exposures to members of the public from the Naval nuclear propulsion program are far less than either the Environmental Protection Agency standards, the guidelines of the Nuclear Regulatory Commission or the exposure from natural background radioactivity.

TABLE 5 RADIONUCLIDE RELEASES ASSUMED FOR ENVIRONMENTAL PATHWAYS ANALYSIS

	Assumed Annual Release, Curie	
Radionuclide	Liquid Release	Airborne Release
Cobalt 60	0.001	0.001
Tritium	0.100	0.001
Carbon 14	*	0.100
Krypton 83m	*	0.020
Krypton 85m	*	0.024
Krypton 85	*	0.001
Krypton 87	*	0.050
Krypton 88	*	0.020
Xenon 131m	*	0.005
Xenon 133m	*	0.010
Xenon 133	*	0.210
Xenon 135	*	0.250
Argon 41	*	0.410

*These gaseous radionuclides are released into the air, not into water.

TABLE 6 ENVIRONMENTAL EXPOSURE TIMES, CONSUMPTION AND CONCENTRATION PARAMETERS ASSUMED FOR ENVIRONMENTAL PATHWAYS ANALYSIS

	Assumed Parameter Value	
Pathway Parameter*	For Highest Individual	For Average Individual
Fraction of Year Occupancy		
For Air Immersion	1	1
For Land Deposition	1	1
Along Shoreline	.05	.0005
Swimming	.01	.0001
Boating	.01	.0001
Food Consumption		
Leafy vegetables, Kg/year	72	18
Water, liters/year	730	180
Fish,** Kg/year	18	2.3
Mollusks,** Kg/year	9	.25
Crustacea,** Kg/year	9	.90
Sediment, Kg/year	1	.10

* Refer to Figure 5

** Cobalt 60 was assumed to concentrate from sea water to the edible flesh of fish, mollusks, and crustacea by factors as follows: fish, 650; mollusks, 170; crustacea, 1,700, based on reference 41.

TABLE 7 ESTIMATED MAXIMUM RADIATION EXPOSURE TO AN INDIVIDUAL FOR ASSUMED LIQUID AND AIRBORNE RADIOACTIVITY RELEASES FROM SHIPYARDS ENGAGED IN NAVAL NUCLEAR PROPULSION WORK

	Maximum Exposure To An Individual	
	NRC Guideline millirem/year	Estimated Value millirem/year
From Radionuclides In Liquid Releases	5 whole body, or any organ	less than 1
From Gaseous Radionuclides In Airborne Releases	5 whole body, or 15 skin	less than 1
From Other Radionuclides In Airborne Releases	15 any organ	less than 1

TABLE 8 ESTIMATED TOTAL WHOLE BODY RADIATION EXPOSURE TO GENERAL PUBLIC WITHIN 50 MILES FOR ASSUMED LIQUID AND AIRBORNE RADIOACTIVITY RELEASES FROM SHIPYARDS ENGAGED IN NAVAL NUCLEAR PROPULSION WORK

Exposure Due to Natural Background Radiation	Exposure Due to Assumed Radioactive Releases
Approximately 100,000 man rem per year	less than 1 man rem per year

AUDITS AND REVIEWS

The requirements and procedures for control of radioactive waste are important parts of the training programs for everyone involved with radioactivity in the Naval nuclear propulsion program. Such training is part of the initial qualification of shipyard workers and of Naval personnel assigned to ships and bases, and is required to be repeated regularly. Emphasis on this training is part of the concept that radiological control personnel alone cannot cause radiological work to be well performed; production and operations personnel and all levels of management are required to be involved in the control of radioactivity.

Checks and balances of several kinds are also set up to help ensure control of radioactivity. First, written procedures exist which require verbatim compliance. Radiological control personnel monitor various steps in radioactive waste processing. In each shipyard an independent organization, separate from the radiological control organization, audits all aspects of radioactive waste processing. Audits are performed by representatives from Naval Reactors headquarters who are assigned full time at each shipyard. Radiological control personnel from headquarters also conduct periodic inspections of each shipyard. In addition, shipyards have made detailed assessments of the environmental effects of shipyard operations and have published reports on the results of these assessments. Similarly, there are multiple levels of audits and inspections for the other Navy shore facilities, tenders, and nuclear-powered ships and for other radiologically controlled functions such as transportation. Even the smallest audit findings are followed up to ensure proper recovery and permanent corrective actions are taken and to help minimize the potential for future deficiencies.

The policy of the Navy is to provide for close cooperation and effective communication with state radiological officials involving occurrences that might cause concern because of radiological effects outside the ships or shore facilities. The Navy has reviewed radioactive waste disposal, radiological environmental monitoring, transportation and other radiological matters with state radiological officials in the states where Navy nuclear-powered ships are based or overhauled. Although there were no occurrences in 1982 which resulted in radiological effects to the public outside these facilities, states were notified when inquiries showed public interest in the possibility that such events had occurred. The Navy has encouraged states to conduct independent radiological environmental monitoring in harbors where Naval nuclear-powered ships are based or overhauled; the resulted of monitoring by states have been consistent with Navy results.

The U. S. Environmental Protection Agency (EPA) has conducted detailed reviews of the Navy's procedures for controlling radioactive waste and for radiological environmental monitoring. An Environmental Protection Agency laboratory has conducted detailed environmental surveys of selected U. S. harbors (references 37, 44, 45, 46, 47, 48). This laboratory has performed these surveys in the harbors at Charleston, South Carolina; Pearl Harbor, Hawaii; San Diego, California; Vallejo, California; New London, Connecticut; Newport News, Virginia; Norfolk, Virginia; Bremerton, Washington; and Kittery, Maine-Portsmouth, New Hampshire. Environmental Protection Agency results have been consistent with Navy results. In the latest such Environmental Protection Agency survey conducted in 1977 at the Portsmouth Naval Shipyard, the Environmental Protection Agency analyzed harbor water, sediment, marine life and air for radioactivity. No radioactivity from shipyard operations was detected.

CONCLUSIONS

1. The total gamma radioactivity in liquids, less tritium, released into all ports and harbors from the U. S. Naval nuclear propulsion program was less than 0.002 curie in 1982. The total tritium released into all ports and harbors was less than one curie in 1982.

2. No increase of radioactivity above normal background levels has been detected in harbor water where U. S. Naval nuclear-powered ships are based, overhauled, or constructed.

3. Liquid waste from U. S. Naval nuclear-powered ships and their support facilities have not caused a measurable increase in the general background radioactivity of the environment.

4. Low-level cobalt 60 radioactivity in harbor bottom sediment is detectable around a few operating base and shipyard piers from low level liquid releases in the 1960's. Cobalt 60 is not detectable above background levels in general harbor bottom areas away from these piers. Maximum total radioactivity observed in a U. S.

harbor of less than 0.05 curie of cobalt 60 is small compared to the naturally occurring radioactivity. Comparison to previous environmental data summarized in references 1 through 17 shows that these environmental cobalt 60 levels are continuing to decrease.

5. Conservative estimates of radiation exposures to members of the public from the Naval nuclear propulsion program are far less than either the Environmental Protection Agency environmental standards, the guidelines of the Nuclear Regulatory Commission or the exposure from natural background radioactivity.

6. Procedures used by the Navy to control discharges of radioactivity from U. S. Naval nuclear-powered ships and their support facilities have been effective in protecting the environment and the health and safety of the general public. Independent radiological environmental monitoring performed by the U. S. Environmental Protection Agency and states have confirmed the adequacy of these procedures.

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APPENDIX

ENVIRONMENTAL MONITORING SURVEY CHARTS

The location of environmental monitoring survey charts for harbors monitored for radioactivity associated with U.S. Naval nuclear-powered ships in the United States and possessions during 1982 are listed below:

California:
  U.S. Naval Air Station, Alameda
  Hunters Point Shipyard, San Francisco
  Mare Island Naval Shipyard, Vallejo
  San Diego Harbor
  San Diego Harbor, Ballast Point Area

Connecticut:
  Electric Boat Division, Groton
  U.S. Naval Submarine Support Facility, New London Harbor
  State Pier Area, New London

Florida: Port Canaveral

Georgia: U.S. Naval Submarine Support Facility, Kings Bay, St. Marys

Guam: Apra Harbor

Hawaii:
  Pearl Harbor Area
  Pearl Harbor Naval Shipyard
  U.S. Naval Submarine Base, Pearl Harbor
  New Hampshire/Maine: Portsmouth Naval Shipyard

South Carolina:
  U.S. Naval Station and Naval Shipyard, Charleston
  U.S. Naval Weapons Station, Charleston

Virginia:
  Newport News Shipbuilding and Dry Dock Co., Newport News
  Norfolk Naval Shipyard, Portsmouth
  U.S. Naval Station Norfolk, Destroyer and Submarine Piers
  Norfolk--Portsmouth, Va., Area

Washington:
  Puget Sound Naval Shipyard
  Bangor/Hood Canal

REACTOR DEVELOPMENT EFFORT

Admiral McKee. I submitted with my prepared statement a summarization of the naval reactors development budget request. It totals $613 million this year, $120 million of which is for uranium enrichment.

There is an aspect of my program I like to reinforce from time to time. Even though this is a development budget, the naval nuclear propulsion program is a cradle-to-grave operation. We invent the reactor plant, we build it, we train the people to operate it, and we take it all the way to disposal. When we try to put together a development program that goes with that, we find it is a circular operation. There is exploratory development, then engineering development, and it progresses into building something. Then, since the plants will run for, perhaps, 40 years, there is a lot of development that continues as we learn more. We have to run the cores for long periods of time to see what they are going to do. There are also materials and component development efforts that were simply not foreseen in the early stages of development.

No other weapons system has this particular type of problem. Our goal is to build a reactor core that will last the life of the ship. We wouldn't go back inside the reactor again, so it has to be designed and built extraordinarily well.

We also have to watch the plant indicators and do development that is required through the life of an operating plant, as well as that which is required in the process of putting together a new one.

This past year has been a good year. It has been a busy year. I took over from Admiral Rickover in February of last year. In the past year we have put six new ships in commission and 4,300 young men completed their training and joined the fleet. We have continued to exercise strict control of radioactivity and disposal of radioactive waste.

DISPOSAL OF RETIRED NUCLEAR SUBMARINES

We are trying to make a decision on the disposal of the old submarines. You probably have seen some information about that. I am prepared to discuss that in more detail if you would like for me to do so.

Senator Johnston. Yes, would you, please.

Admiral McKee. All right, sir.

The disposal of the submarines at this stage amounts to a research and development effort. Some information has been put together in a draft environmental impact statement. Public hearings have been held in four States. We intend to listen and take comments from the public and prepare a final statement.

There are two basic alternatives that were considered. One is land disposal and the other is sea disposal. We have made no decision on which to do.

Now, to give you an idea of what that all means, let me show you a couple of slides. What we are talking about is how to dispose of the reactor portion of the submarine, which is not high-level waste. Any ship that is disposed of will be disposed of without the core. The reactor compartment is made of HY-80 steel, and is about [deleted] inches thick. It is built to withstand external submergence pressure. The end bulk heads are designed to withstand [deleted].

The reactor compartment would contain the reactor plant itself without the reactor core. The radioactivity in there is in the metal. Neutron irradiation activates the heavy metal portions of the system. So what we want to do is dispose of it intact.

Basically, though, for any radioactivity to leach out into the environment, whether it is in the ground or in the water, requires rusting through first the hull, which is [deleted] thick [deleted] and then the reactor vessel itself, which is [deleted] thick, depending on which plant it is. It takes a long time to do that.

To give you an idea of how long, the British recovered a submarine that sank in 1912. The hull is not very thick. It was in about 200 feet of water, where corrosion occurs faster than in deeper water. They brought it up virtually intact, almost not rusted at all. So decomposition of the metal is a very long process.

As you know, we pulled pieces of the *Monitor*, the Civil War ship, up off the bottom of the ocean off the coast of South Carolina still intact.

Senator JOHNSTON. Still intact?

Admiral McKEE. The wood was falling apart, but the big armor is still intact. I have a piece of it that I meant to bring along and throw on the table. You can see it takes a long time for the metal to rust away, and the *Monitor* used very unsophisticated metal.

Senator JOHNSTON. When you say "long time," we are talking about what?

Admiral McKEE. Hundreds of years.

Senator JOHNSTON. Hundreds of years?

Admiral McKEE. Yes, sir, hundreds of years. Now what we have been doing as part of our research and development program is to take samples of all the kinds of metals involved in building our reactor plants and put them down 13,000 feet on the bottom of the ocean and every year or so we go back and pick up some of them to look at and analyze. That is continuing to go on. While we will not be able to get long-term corrosion data in the deep ocean, we have learned enough to know deep ocean corrosion is slower than in shallower water, where long-term data does exist. In most experiments you can accelerate pressure and temperature effects, but it wouldn't be valid for corrosion in the ocean.

Senator JOHNSTON. All you would be left with is alphas and betas radiation after the number of years; is that right?

Admiral McKEE. What would basically be left is nickel 59, a very weak gamma emitter, and nickel 63, a beta emitter.

Senator JOHNSTON. How long would that last?

Admiral McKEE. I didn't bring my decay charts, but those are the only two left after a period of a hundred years of decay.

Senator JOHNSTON. What I am getting at is, if you buried it at sea and after a period of time the whole thing leached out into the water, is that a big problem?

Admiral McKEE. Get the blackboard up here. I will draw you the slide I didn't show you.

It is really a race between the decay of the material due to corrosion, that is the physical decay of the metal, and the radioactive decay of the active elements in the material.

If you look at the two curves—this is time, this is rust—radioactive decay looks something like this over some period of time. If we look at the time it takes to rust, it is a similar-looking curve that runs out like this, except remember, we have to rust through three things. We have to rust through the hull and the reactor vessel. Then we have to rust the irradiated material itself and disperse it. So what you really have is a three-part decomposition—the hull, the vessel, and then the internal structure material.

The question is: By the time the material has decayed far enough to release radioactivity to the currents and the ocean, how much radioactivity is left? Our predictions say we will be well within safe levels. We will be far down on this radioactive decay curve before we even begin to approach this point on the curve that shows where radioactive material can be released.

Senator JOHNSTON. I can appreciate that. For the purpose of monitored retrievable storage, we look at some of these curves and after something between 600 and 1,000 years the gamma activity is down to pretty close to natural uranium.

Admiral McKEE. Yes, sir.

Senator JOHNSTON. But the question in my mind is, after you are down to natural uranium, the kind of metal that you have, since it is subject to rust, does that disperse in the seawater more quickly than another kind of thing would? And what would be the surface potential for contamination?

Admiral McKEE. I have a slide on that. Our calculations during the year of largest impact—in other words, at the point where there is beginning to be some release of the material, and the radioactivity is not fully gone—the largest impact on an individual is extremely small. This estimate is high by orders of magnitude, but we have taken the most conservative approach. These are the numbers in terms of exposures.

Now, the question is: What will happen to the rusted material on the ocean bottom? It sinks and stays put. And, of course, we have two submarines down now that went down with the radioactive fuel on board. *Scorpion* and *Thresher* both went down [deleted]. We have seen no evidence that significant amounts of radioactive material have dispersed at all. In fact, there is virtually no radioactivity down on the ocean bottom in the vicinity of those wrecked submarines. They went down with the cores intact, fully intact cores that were operating at the time.

So we don't believe, based on that practical experience and the physical characteristics of the metals in an oxidized state, that they will be the kind of thing that will float around the ocean. Ocean dispersal is the liveliest subject.

Land disposal looks sort of like this. What we do is cut the submarine up in this method, cut the reactor compartment out of it, and——

Senator JOHNSTON. I see. You plan to sink the whole submarine.

Admiral MCKEE. We would put the whole submarine down and flood it because we don't want air inside. We want the whole thing full of water. We modify the submarine so it will do that. We have done a number of model studies to prove it is going to end up where we want it to, which is very important. Anything dropped in the ocean tends to wander on the way down. So we spent some money to build large models and test the flooding arrangements to make sure it will come down where we want it to.

What we do to get it down is right here. What we would do is take the stern planes and the sail planes off, which are the things that make it tend to want to wander, and put big flooding ports on it. We just let it flood, and it just sort of goes down like the seeds that come out of a tree that sort of wander around and land at the base of the tree.

Senator JOHNSTON. What you are telling me, as I gather from this, is that sea disposal is a whole lot cheaper and probably perfectly safe, but the problem, again, is public perception.

Admiral MCKEE. That is exactly right. The public perception is difficult. Our last hearing in California was pretty lively.

Senator JOHNSTON. When would you be ready to sink your first submarine?

Admiral MCKEE. Probably 5 years from now. We have a number of them to dispose of over a period of time. But it really depends on how long you operate a submarine. Thirty years looks like the average lifetime. So disposal will go on for a long period of time.

We can do disposal either way. What we are trying to do by going at it the way we are is to establish the right posture by taking the time to make the proper decision with all the public input. We may do a combination of both; maybe that is the right thing to do. We haven't determined the answer yet, but we think we can do it safely. The two unfortunate accidents in real life tend to confirm that.

Last week I returned from the initial sea trials of a nuclear submarine, my third in a 2-week period. *Florida*, the latest Trident submarine, and two 688-class attack submarines. The fourth nuclear-powered aircraft carrier, *USS Carl Vinson*, was delivered last year, and the fifth, *Theodore Roosevelt*, is coming along well. She is due to be delivered in 1986. We are well into procurement for the two carriers authorized by Congress last year.

An important point to recognize, Senator, is that nuclear-powered warships represent over 40 percent of the combatant strength of the Navy today. That tends to be forgotten, but it is critically important. As you well know, our ships represent 100 percent of the most survivable leg of the strategic deterrent.

SUBMARINE SURVIVABILITY

Senator JOHNSTON. I take it you share the view of the CNO that the oceans are getting more opaque.

Admiral MCKEE. No question about it, sir. My last job was Director of Naval Warfare. I spent 3 years in that job and a lot of money looking at it, and let me tell you, he is right.

Senator JOHNSTON. Can you tell me what percentage of our hard-target kill is in submarines?

Admiral MCKEE. Well, sir, what you really have to ask is, how capable are our submarines of doing hard-target kill today? [Deleted].

I am a little bit out of my job code when I talk about that, because I am in charge of the propulsion plant.

Dr. WAGNER. Could I interject a point?

Senator JOHNSTON. Yes.

Dr. WAGNER. The calculation depends on how feasible you think it is to [deleted].

Admiral MCKEE. As I said, we didn't design it for that. In fact, years ago when we first tried to initiate research into inertial stellar guidance, [deleted].

Senator JOHNSTON. That has been changed since.

Admiral MCKEE. Yes, sir, that has been changed. But what I am talking about was back in the early seventies.

Dr. WAGNER. Yes.

Senator JOHNSTON. Trident II will definitely have that capability.

Admiral MCKEE. Yes, sir.

Nuclear-powered ships continue to maintain an unprecedented peacetime tempo of operation. They steam long and hard, yet they maintain the best readiness record of any of the Navy's ships. They are more complicated than any of the rest, [deleted] consistently higher than any other ships in the Navy.

SUBMARINE PERSONNEL FORCE

Their commitments are long and arduous. They are, in effect, wartime commitments in terms of time at sea, particularly for submarines. Our ability to meet these commitments still rests entirely on the skill of a handful of people. The submarine force is operated by approximately 6 percent of the people in the Navy. That is a big bargain in terms of personnel cost. The naval reactors organization that supports the nuclear-powered fleet consists of only about 200 engineers, extraordinarily talented people in great demand. Because they do an awfully good job, the nuclear-powered fleet has been able to continue to operate safely.

Senator JOHNSTON. Morale is very high?

Admiral MCKEE. Morale is high. But these guys are under extreme pressure because we ask so much of them. We ask them to learn almost more than anyone else. We ask them to prove it and prove it and prove it over and over again. Ask your doctor sometime when the last time was that he qualified on the operation he is about to do. [Laughter.] But we do that. And the men who hold the technical end together are critically important. In fact, they are irreplaceable. Most of them are guys who had been with Admiral Rickover many years. They, too, are in intense demand on the outside.

One of the pieces of mythology is, because the nuclear power industry has had a few upsets in recent past that, perhaps, the demand for qualified individuals is not as great. But the fact is that the demand for nuclear-trained officers and enlisted men is greater than ever because our industrially-oriented, technologically-oriented society is looking for bright young people who have carried a heavy load of responsibility and have the right tools to do the job. It doesn't matter what the job is.

Their morale is good. These men are doing a superb job. But let me tell you it is kind of hard—I have been through it myself—to tell your wife why you are still going to be in this outfit that pays you half as much as Amalgamated Bottle Co. is going to pay. It is tough.

Now, the help we have gotten from the Congress in the past is critically important. We were in serious trouble in terms of getting and retaining ships' crews until the last series of legislation that put incentives in place and gave us the financial base to keep these people. The personnel situation improved, but let me tell you it is terribly fragile. Every time we go through a cycle, we can measure it in terms of retention.

For example, I just read in the paper this morning that the Senate had approved the selective reenlistment bonus which was due to expire on the 31st of this month. This kind of uncertainty—will it or will it not be reinstated—is clearly manifested in our retention trends. Not in enlistment. Enlistment is great at this time. Today we are getting some of the best young officers and men I have ever seen. But we put so much into them and ask so much of them that the problem is in retention. The two tend to be confused.

I am running 168 nuclear reactors. I am training over 3,000 young folks a year. It is expensive to do that. That is why my budget is where it is and the Navy budget also reflects it.

WATER-COOLED BREEDER REACTOR

Senator JOHNSTON. Let me ask, do you want to say something about your water-cooled breeder?

Admiral MCKEE. Yes, sir. I will do that. The water-cooled breeder was shut down in October 1982. The defueling effort is well along. We are cutting mechanisms out right now. We expect to have the defueling finished by the end of 1984. We will begin the proof-of-breeding effort following that. The proof-of-breeding should run until 1987. Shippingport will be decommissioned at the completion of defueling. That will be handled by somebody else in the DOE.

About $100 million will be spent between now and the time we are finished. About half of that is to get the defueling finished. The other half is to perform the proof-of-breeding, which is really the return on investment we made in this thing.

It is going well, The core operated for almost 29,000 full power-hours, roughly twice as long as it was originally designed to operate. It operated trouble-free. All of our indicators said it did all that it was supposed to do. We think it did the breeding. But to confirm this technical achievement, we must go on to do the proof-of-breeding work to verify it.

Senator JOHNSTON. You understand it is going to be very hard to fund that. I mean, Clinch River is very much under attack, and this is——

Admiral McKee. Yes, sir. But if you have put up $600 million to do an experiment and it only costs you $50 million more to find out the results—and that is what we are talking about for proof-of-breeding—I think you would have to think a long time before deciding to stop at that point.

The point, too, if it works, is that we have a system that could be used as a breeder in any pressurized water reactor in the country. You won't make a lot of fuel with this breeding concept because it is a small percentage return, but what you can do is go for several hundred, 300, 400, even 500 years on the thorium that we have. We have plenty of thorium. So it is a nice insurance policy. If the Clinch River stumbles or if we aren't——

Senator Johnston. I support the Clinch River.

Admiral McKee. Yes, sir, but not everybody does.

Senator Johnston. That is right.

Admiral McKee. It is having its trouble. I don't propose to compete with Clinch River. Certainly thoughtful ways to do the energy job ought to be examined. But I would certainly hate to see us throw away $600 million and all of that technical effort to save $50 million. While $50 million is a lot of money, it is a very small percentage of the investment. So I think we should work very hard to finish the job.

QUALITY OF SUBMARINE CONSTRUCTION

I would like to say one more word about the submarines. The submarines we build today, and our surface ships, are the best in the world. There is no question they are the best in the world for what we do today. What we do today is not really the issue, however. The budget you are looking at is going to dictate what we are able to do 10 years from now. So it makes it hard to make a comparison with the Soviets.

Senator Johnston. Tell me, what are the things you want to be able to do in the next 10 years regarding command and control?

Admiral McKee. Yes, sir. We need to build the submarine force level to 100 first-line submarines. Right now it is near 100, but it is a hodgepodge of new boats, old boats, and excess ballistic missile submarines. Really the effective number is somewhat less than that. We need to get on with the new attack submarine design.

Our current first-line attack submarine was in design when I was working for Admiral Rickover as a lieutenant commander in 1964. That was the last time we really started into a new attack submarine design. We have not designed a new attack submarine since then.

[Deleted.]

[Deleted.] We have an edge. The 688-class submarine can whip any Soviet submarine today. [Deleted.] So we need to get on with the design of the new submarine, [deleted].

Senator Johnston. Admiral, I have a vote here. How much more testimony would you have?

Admiral McKee. I am about finished, sir. It is up to you. What do you want to hear from me?

Senator JOHNSTON. Well, I am very interested. Why don't you go ahead and wrap up, because we may have votes back-to-back there on the floor. I don't want to keep you waiting.

Admiral McKEE. I will just finish and say we know how to do it. The submarines we build now are awfully good, but we need to build them quieter and faster. We particularly need to build a submarine that can listen and operate at high speed while still being quiet. As you know, noise is a function of speed. The faster you go, the more noise you make. [Deleted.]

Senator JOHNSTON. The fastest submarine is the Soviet submarine.

Admiral McKEE. ALFA, yes, sir.

Senator JOHNSTON. But it is [deleted].

Admiral McKEE. [Deleted.]

Senator JOHNSTON. [Deleted.]

Admiral McKEE. [Deleted.]

Senator JOHNSTON. [Deleted.]

Admiral McKEE. [Deleted.]

Senator JOHNSTON. [Deleted.]

Admiral McKEE. [Deleted.]

Senator JOHNSTON. [Deleted.]

Admiral McKEE. [Deleted.]

[Deleted.] We don't think that is what we ought to be doing. We ought to build a submarine that has the right balance of weapons, speed, and sensors. That is what we need to get on with.

The ships we have now are awfully good, [deleted].

Senator JOHNSTON. I think, basically, you are very pleased with where we are now with our subs and we want to keep the same relative position, and we have to continue to improve and continue to do what you are asking us to do here.

Admiral McKEE. Yes, sir. That is right.

Senator JOHNSTON. I very much believe in the submarine fleet. I think we have to give you what you need to do the job. It has been an excellently managed program through the years as far as I am concerned. We have no complaints. As far as I am concerned, I want to give you what you need to do that job, because while you can argue the triad, you can't argue really what I consider to be the first leg of the triad, which is the submarine fleet. They may find some way to make those oceans invisible, but it is going to be a long time coming.

Admiral McKEE. Not in the years of my lifetime, sir.

ADDITIONAL QUESTIONS FOR THE RECORD

Senator JOHNSTON. That is right. That is the first line of defense.

We do have some other questions we would like for you to respond to.

[The questions and answers follow:]

QUESTIONS SUBMITTED BY SENATOR HATFIELD

Naval Reactors

Question: In your statement, you say that our submarines are capable of handling any competition on its own terms. On what areas of submarine operations do the Soviets place the most emphasis, and how would our attack submarines fare against Soviet submarines in these situations?

Answer: Basically, the Soviets build two types of attack submarines - tactical cruise missile submarines designed to attack surface ships, and submarines which primarily carry torpedoes designed to attack other submarines and surface ships. These ships are in addition to strategic ballistic missile submarines. We use our own submarines to detect and attack Soviet submarines and to provide anti-submarine detection for carrier battle groups since a submarine is the best counter to any kind of Soviet submarine.

Our submarines would do very well in both missions, but each presents a different tactical problem. When a submarine operates independently it can take its time without worrying about rapidly getting into position to shoot at the other submarine. When escorting surface ships, however, you can't take your time, because the other submarine might get off the first shot.

So what it comes down to is response time. You improve response time by building submarines that can stay quiet at higher speeds because that allows you to cover an area more quickly and it also enables you to solve the tactical problem more quickly. Right now, in any one-on-one situation, our submarines are clearly better than the Soviets'. They will continue to be better because we will always get the first shot off as long as we can continue to maintain a superior response time.

Question: What advances do you foresee being incorporated in the new design attack submarine in order to maintain our competitive edge over the Soviets?

Answer: In determining the advances which should be incorporated into a new design attack submarine it is important that we consider what the Soviets are doing. Soviet advances in submarine quieting, combat capability, sustainability and speed are evident as seen in the VICTOR III, ALFA, OSCAR, and TYPHOON Class submarines. The Soviets are expected to demonstrate further advances in attack submarines in the ten years that it will take us to get a new attack submarine to sea.

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The Soviets are incorporating technical advances into their submarine designs that increase size. For example, the Soviet OSCAR Class is about tons submerged displacement compared to about 6,900 tons for our 688 Class. Their TYPHOON Class is about tons compared to about 18,000 tons for our TRIDENT submarines. [

deleted

Considering the Soviet threat in the 1990's and our research and development programs, a balanced mix of ship and combat system advances should be incorporated into the new design attack submarine. These advances would increase ship capability, and increase the SSN force effectiveness thus helping to offset both the technical advances being made by the Soviets and their numerical advantage.

Advances in combat capability are necessary for a new design submarine. Improvements are possible in several major areas - quieting, speed, sonar, arctic operation capability and weapon load.

Improved quieting is of utmost importance in order for us to continue our acoustic advantage over the Soviets. This can be accomplished through

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These advances would allow a higher passive sonar search speed and transit speed for longer range missions

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An increase in the speed of the new design submarine over the SSN 688 Class will improve the capability to track high speed Soviet submarines, shorten response time in a tactical situation, improve torpedo evasion, and reduce the time to get to station. The speed increase would be possible through use of an improved hull length to diameter ratio, improved performance machinery and an advanced reactor plant.

Improved submarine sonars coupled with improved quieting will provide the needed acoustic advantage in the 1990's and will assure the effectiveness of the submarine as an anti-submarine warfare platform.

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A significant increase in the number and size of torpedo tubes and in the number of weapons reloads is also under consideration for the new design submarine to improve sustainability. These features would provide greater weapon flexibility and more rapid weapon delivery, shorten reaction time, reduce vulnerability and permit increased time on station. In addition, improvements to provide greater survivability for the new design submarine such as better damage control features in the engine room and improved ship controls should be provided to assure the submarine can stay and fight.

Question: What do you see as the principal emphasis of Soviet submarine design and development today?

Answer: The major emphasis in recent Soviet submarine designs, the VICTOR III SSN, OSCAR SSGN, and TYPHOON SSBN, has been in areas related to improvements in military capabilities. These include

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In particular, the OSCAR and TYPHOON Classes have estimated displacements much larger than their predecessors allowing substantial improvements in these capabilities.

Improvements in submarine combat capability are expected to continue to be emphasized by the Soviets throughout the next decade. Continued improvements in other important areas of Soviet submarine desigh such as depth, speed, hydrodynamics, and propulsion are also expected.

Question: Please describe the increases in the reactor development program in FY 1984.

Answer: The increase results primarily from escalation and the procurement of components and materials for core development. The Advanced Fleet Reactor effort has reached the point where we must procure a substantial amount of material for the prototype core and associated components.

Question: Describe the status of the Materials Facility construction project at Savannah River.

Answer: The Materials Facility is well along. Design for the facility is nearly 50% complete, the technology transfer laboratory has been completed, and utilities have been relocated on the site. In addition, we have placed a number of contracts for building materials and work on the foundation has begun. We hope to begin erecting the main manufacturing building later this year. The project is progressing on schedule and we foresee no obstacles to its timely completion.

Question: Describe come of the dangers you foresee with having only one fuel fabrication facility at Erwin, Tennessee. What is the status of that facility?

Answer: NFS is operating on a three-shift-per-day, seven-day-per-week schedule. Even at this maximum operating tempo, NFS may not be able to supply sufficient fuel to support the requirements of the nuclear fleet.

The main concern, however, is the possibility of shutdown. Production of fuel by Nuclear Fuel Service, NFS, could be disrupted in several ways, including labor strikes, natural disasters such as floods or tornadoes, operational or regulatory action, or economic business decisions.

NFS both carries out fuel development work and provides production fuel to make cores. An extended interruption would interfere with the development effort and seriously disrupt core manufacture - possibly causing the loss of a naval core supplier - and jeopardize the nuclear powered fleet.

For your information, negotiations are nearly complete on a new five year contract with NRF.

Water Cooled Breeder

Question: Describe the status of and plans for the water cooled breeder reactor program.

Answer: The Shippingport Atomic Power Station was shut down in October 1982 and end-of-life testing and reactor defueling began. The light water breeder core installed in the plant's reactor operated successfully for five years, achieved 28,730 full power hours, and generated over 2.1 billion kilowatt hours of electricity.

Question: Have you had any recent indications of utility interest in this program?

Answer: Yes - the General Accounting Office recently contacted several utilities with nuclear power plants and groups involved in nuclear energy concerning industry interest in light water breeder core evaluation information. The general consensus was that the core evaluation program should be completed in order to know if the water cooled breeder concept works and to know whether the technology can be applied later, should the Nation need it. In addition, respondents asked to obtain the core evaluation information at an early date to assist in making improvements in current light water reactor designs.

Question: What must be done to determine whether breeding was achieved in the light water breeder core?

Answer: Breeding will be determined by measuring the amount of fissile nuclear fuel in the expended core and comparing this result with the original amount of fissile fuel in the core. Confirmation that the amount of fissile fuel has increased by about the expended amount will show that breeding was achieved.

The expended core measurement is being done by nondestructively assaying a random, representative sample of 500 fuel rods from 12 fuel assemblies taken from the more than 17,000 fuel rods in 39 fuel assemblies of the expended LWBR core. The number of rods assayed together with the assay methods were established to satisfy measurement requirements to confirm breeding in the light water breeder reactor core.

Question: What is the status of the proof of breeding program for the light water breeder reactor?

Answer: The core evaluation effort to examine and determine the degree of breeding will begin when the spent fuel modules arrive at the Expended Core Facility and extend over a four year period. Equipment procurements and engineering work for the core evaluation effort are presently underway.

Question: Is it possible to confirm breeding was achieved in the light water breeder core based on data you obtained during its operation?

Answer: The extensive operational testing of the light water breeder core confirmed much about the practical operation of this type core. However, the small fissile fuel breeding gain of the light water breeder reactor, and the many individual effects which strongly influence breeding and core operation in contradictory ways, make it impossible to determine from operational data whether or not breeding was actually achieved. For example, if fission product poisoning in the core was actually less than predicted, operational data would indicate the core to be more reactive than predicted and it would also be breeding better than predicted. On the other hand, increased reactivity could be caused by fuel rod shrinkage being greater than expected, which would cause breeding to be worse than expected. The large number of such contradictory effects and the substantial sensititivy of breeding performance to these effects preclude use of operational data to confirm breeding.

Question: What were the conclusions of GAO in their recent survey of the Water Cooled Breeder Program?

Answer: The GAO's draft of a proposed report titled, "The Core Evaluation Phase of DOE's Water Cooled Breeder Program" stated that the DOE's planned end-of-life effort is a cost effective way of completing the water cooled breeder program. The report also concluded personnel levels of defueling the Shippingport Atomic Power Station are comparable to staffing levels involved in similar activities at commercial nuclear power plants. The GAO's survey of utilities and industry groups found that 8 out of 9 contacted have an interest in the results of the core evaluation and believe that the efforts should continue.

Question. The water cooled breeder core operated for nearly twice as long as its original lifetime objective. What is the significance of this? Did you experience any problems with the core in view of the extended operation?

Answer: Extended operation provided a unique opportunity to develop a better understanding of the physics and engineering aspects of the thorium/uranium fuel system. It will allow more accurate performance predictions for future applications and better definition of the reprocessing and refabrication limits required to achieve the breeding cycle. Furthermore, long lived cores are important from the standpoint of economics, conservation of resources, occupational radiation exposure, and the management of nuclear waste. Extension of the Light Water Breeder Reactor core life was beneficial in all these areas and adds to the value of this technology in the nuclear power industry.

The light water breeder core operated well throughout the five year period and achieved 28,700 effective full power hours. The extended operation did not result in any technical or operational problems and all data indicate fuel clad integrity was maintained during the entire core operation.

Question: What is the status and future plans for the Shippingport site?

Answer: Power operation of the Shippingport station was terminated on October 1, 1982, after a quarter century of pioneering development of nuclear technology. End-of-life testing of the third core, the Light Water Breeder Reactor core, has been completed and defueling of the station has begun.

The last spent fuel shipment is expected to be complete before October 1984. At that time, responsibility for the government-owned reactor plant portion of the station will be transferred to another group within the Department of Energy for decommissioning.

SUBCOMMITTEE RECESS

Senator JOHNSTON. I have to go vote. Thank you very much, Admiral McKee.

Admiral McKEE. Thank you, Mr. Chairman.

Senator JOHNSTON. The subcommittee will recess, subject to call.

[Whereupon, at 4:33 p.m. Thursday, March 17, the subcommittee was recessed to reconvene at 10 a.m. Wednesday, March 23.]

LIST OF WITNESSES, COMMUNICATIONS, AND PREPARED STATEMENTS

Page

Bradley, George, Principal Deputy Assistant Secretary for International Affairs, Department of Energy:
  Prepared statement 633
  Biographical sketch 639
Brewer, Shelby T., Assistant Secretary for Nuclear Energy, Department of Energy 813
  Prepared statement 815
Chiles, J. Hunter, III, Director, Office of Policy, Planning, and Analysis, Department of Energy:
  Prepared statement 368
  Biographical sketch 627
Chipman, Gordon, Deputy Assistant Secretary, Reactor Programs, Department of Energy 813
Coffman, Franklin E., Director, Office of Terminal Waste Disposal and Remedial Action, Department of Energy 813
Cross, Robert J., Administrator, Alaska Power Administration 805
  Prepared statement 807
Davis, Robert W., Deputy Assistant Secretary for Environment, Safety, and Health, Department of Energy 1061
  Biographical sketch 1067
Douglas, Rosslee G., Director, Office of Minority Economic Impact, prepared statement 375
Geisinger, Harry C., Administrator, Southeastern Power Administration 789
  Prepared statement 790
Hesse, Martha O., Assistant Secretary, Management and Administration, Department of Energy:
  Prepared statement 611
  Biographical sketch 615
Hodel, Donald Paul, Secretary of Energy 585
  Prepared statement 586
Johnson, Peter T., Administrator, Bonneville Power Administration 675
  Prepared statement 678
Johnson, R. Tenney, General Counsel, Department of Energy:
  Prepared statement 616
  Biographical sketch 619
Kinnaird, Adm. R. McKee, Director, Naval Nuclear Propulsion Program 1217
  Prepared statement 1218
Lawrence, Michael, Director of Storage, Nuclear Waste Policy Act Project Office, Department of Energy 813
McPhail, Robert L., Administrator, Western Area Power Administration 733
  Prepared statement 735
Memorandum of Understanding Between the U.S. Nuclear Regulatory Commission and the Department of Energy concerning the removal and disposition of solid nuclear wastes from cleanup of the Three Mile Island unit 2 nuclear plant 916
Morgan, Robert L., Project Director, Nuclear Waste Policy Act Project Office, Department of Energy 813

Page

Odle, Robert C., Jr., Assistant Secretary, Congressional, Intergovernmental, and Public Affairs, Department of Energy:
  Prepared statement ... 628
  Biographical sketch ... 630
Richards, James R., Inspector General, Department of Energy:
  Prepared statement ... 620
  Biographical sketch ... 623
Risk, Richard B., Jr., Administrator, Southwestern Power Administration ... 775
  Prepared statement ... 776
Roser, Herman E., Assistant Secretary for Defense Programs, Department of Energy ... 1079
  Prepared statement ... 1079
San Martin, Robert L., Deputy Assistant Secretary for Renewable Energy, Deprtment of Energy ... 939
Tribble, Joseph J., Assistant Secretary for Conservation and Renewable Energy, Department of Energy ... 664, 939
  Prepared statement ... 667, 941
Trivelpiece, Alvin W., Director, Office of Energy Research, Department of Energy ... 981
  Prepared statement ... 982
Vaughan, William A., Assistant Secretary, Environmental Protection, Safety, and Emergency Preparedness, Department of Energy ... 1061
  Biographical sketch ... 1066
  Prepared statement ... 1062
Voigt, William R., Jr., Deputy Assistant Secretary for Uranium Enrichment and Assessment, Department of Energy ... 813
Wade, Troy E., II, Principal Deputy Assistant Secretary for Defense Programs, Department of Energy ... 1079
Wagner, Richard L., Assistant to the Secretary of Defense (Atomic Energy) ... 1079
  Prepared statement ... 1153

SUBJECT INDEX

DEPARTMENT OF ENERGY

Page

- Atomic energy defense programs 593, 602
- Barnwell, funding for 608
- Clinch River Breeder Reactor 594, 604, 658
- Conservation and renewable research 594
- Department of Energy, termination of 597
- Energy research and development 594
- Energy technology centers, transfer of 656
- Fusion energy program 654
- General and basic energy sciences 594
- General science and basic research 595
- Great Plains coal gasification project 655
- High-temperature gas-cooled reactor 653
- International nuclear cooperation, newly-instituted 606
- Magnetic fusion 608
- Monitored retrievable storage 651
- Natural gas, deregulation of 595
- Nuclear and renewable energy program balance 596
- Nucler waste disposal 597
- Nuclear Waste Policy Act 650
- Power marketing coordination 609
- R&D priorities 601
- Solar and conservation, fiscal year 1983 deferrals for 609
- Strategic Petroleum Reserve 652
  - Crude oil purchase requirements 656
  - Projected cost of crude oil 657
- Tax credits 601
- Uranium mill tailing remedial action program 660

ATOMIC ENERGY DEFENSE ACTIVITIES

- Construction projects, major 1180
- Defense Waste Processing Facility 1169
- Defense waste and byproducts management 1168, 1179
- Directed energy weapons 1161
- HTGR breeder concept 1167
- Inertial confinement fusion 1160, 1190
- Isotope separation, special 1195
- L reactor 1206
- Materials production 1191
- MX:
  - Basing mode 1164
  - Related issues 1162
- Nuclear materials production 1166
- Production reactors 1168
- Productivity improvements 1159
- Proton beam fusion experiments 1165
- Research, development, and testing 1160, 1176
- SENTRY/LoAD system 1184
- Stockpile builds 1208

Page
Supply options, costs of 1193
Verification and control technology 1170
W79 8-inch AFAP 1185
W80 ALCM warhead 1186
W85—Pershing II warhead 1187
W87—MX warhead 1173
Waste isolation pilot plant 1207
Weapon survivability 1210
Weapons:
  Activities 1188
  Aging of 1213
  Deployment 1213
  Production 1159

ENVIRONMENTAL, SAFETY, AND HEALTH PROGRAM

Budget request, summary of 1067
Policy and management 1069
Liquefied natural gas:
  Estimated cost 1070
  Safety 1069, 1070, 1074
Congressional earmarking, process of 1071
Marshall Islands and related sites 1073
Nuclear safety activities 1075
Pantex plant, Tex., EIS 1076
Savannah River L-reactor 1077

FEDERAL POWER MARKETING ADMINISTRATIONS

Alaska Power Administration:
  Budget request 805
  Emergency fund 805
  Power programs, State and Federal 806
  Replacements, deferred 811
  Snettisham project, Crater Lake unit 805, 811
  Transmission problems 805
Bonneville Power Administration:
  Aluminum industry 699
  California power costs 702
  Conservation program 677
  Cost reductions 715
  Customer groups, average rates for 700
  Equipment purchases, deferred 728
  Federal and State power programs, combining 727
  Fish and wildlife program 704, 730
  Load resource forecast 710
  Marketing 711
  Northwest Council:
    Fish plan 706
    Plan rate impact 708
  Pacific Northwest energy situation 675
  Power sales outside the Northwest 701
  Power, costs of 701
  Program costs, reduction in 694
  Rate increases 710
  Regional planning council 677
  Repayment status 704, 726
  Revenue projections, changed 676
  Supply system projects 698

Bonneville Power Administration—Continued

Page
Surplus power for industries 695
Washington public power supply system (WPPSS) 676, 697, 712
Federal power, market value pricing for 673
FERC review of rates 664
Interest rates on newly invested capital 664
Repayment to the Treasury 674
Revolving funds 665

Southeastern Power Administration:

Automated data processing equipment 803
Budget request 799
Budgetary requirements, reducing 804
Headquarters, relocation of 801
Litigation 804
Overview 800
Personnel, additional 802
Power marketing policy formulation 800
Power rates, present 800
Purchase power and wheeling 799
Revenue estimates 801
Water supply outlook 803

Southwestern Power Administration:

Budget request 785, 787
Litigation, status of pending 786
Southwestern anniversary 787
System rates and repayments 786
Water budget 705

Western Area Power Administration:

Colorado River basin marketing fund 765
Colorado River storage project 774
Construction activities, status of 766
DC tie program 767
Emergency fund 758, 761
Missouri basin program 773
Pacific Northwest-Pacific Southwest intertie 767
Personnel requirements 758, 761
Pick-Sloan Missouri basin program power allocations 771
Repayment status 768
Revenues, rates, and repayments 733
Rifle-San Juan transmission line, status of 760
System operations and maintenance 765
Western issues 733

HIGH-ENERGY PHYSICS, BASIC RESEARCH, ENVIRONMENTAL RESEARCH, AND MAGNETIC FUSION PROGRAMS

Accelerator facility upgrade projects 1052
Basic energy sciences 1053
Biological and environmental research 1059
Energy Research Advisory Board 1034
Fermilab capital equipment 1049
Heavy ion fusion research 1054
ISABELLE 1039, 1050
Magnetic fusion energy 1056
National Center for Advanced Materials 1034

Nuclear medicine program:

Benefits 1039
Budget reduction 1043
Stanford Linear Accelerator Center 1036

Page

- Stanford linear collider 1035
  - Construction funding 1048
- Stanford Synchrotron Radiation Laboratory 1051
- Three national centers 1045
- U.S. program, importance and standing of 1044
- University:
  - Instrumentation program 1035
  - Research support 1055

NAVAL REACTOR DEVELOPMENT PROGRAM

- Naval reactors 1307
- Nuclear submarines:
  - Disposal of retired 1299
  - Personnel force 1303
  - Quality of construction 1305
  - Survivability 1302
- Reactor development effort 1299
- Water-cooled breeder reactor 1304, 1309

NUCLEAR FISSION AND URANIUM ENRICHMENT PROGRAMS

- Advanced isotope separation 929
- Base breeder program 906
- Clinch River Breeder Reactor 897, 903, 905
  - Funding alternative 901
  - Termination costs 903
- Gas centrifuge enrichment 923
- LOFT international program 909
- LWR extended burnup program 908
- Monitored retrievable storage 932
- Nuclear Waste Policy Act 900
- Nuclear:
  - Budget 898
  - Licensing 897
  - Summary of issues 899
- Prototype breeder, large-scale 906
- Research and test reactor program, reduced enrichment at 909
- Three Mile Island 897, 914
- Uranium enrichment 898, 920
- Uranium mill tailings remedial action program 911
- West Valley demonstration project 914

SOLAR, CONSERVATION, AND RENEWABLE ENERGY PROGRAMS

- Balanced energy program 954
- Biomass 964
  - Regional program 958
- Gas turbines, wood-burning 974
- Geothermal:
  - Budget 955
  - Reno, Nev., hearing projects 979
  - Research and development 962
  - Salem Plaza project 959
  - Susanville project 958
- Hawaii deep-water cable program 978
- Oil prices 956
- OMB, request to 956
- OTEC preliminary designs, funding for 977
- Photovoltaic 968

Page
PMA rates, FERC review of 976
Solar energy budget 955
Solar thermal 972
Solar, active and passive 961
Tax credits 960
Wind energy 962